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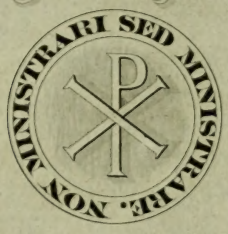

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No. 35623

MEDICINAL PLANTS

BEING

DESCRIPTIONS WITH ORIGINAL FIGURES

OF THE

PRINCIPAL PLANTS EMPLOYED IN MEDICINE

AND AN ACCOUNT OF THE

CHARACTERS, PROPERTIES, AND USES OF THEIR PARTS AND PRODUCTS OF MEDICINAL VALUE.

BY

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THE PLATES BY DAVID BLAIR, F.L.S.

IN FOUR VOLUMES

VOL. II (Nos. 70–146)

LEGUMINOSÆ to VALERIANACEÆ

LONDON

J. & A. CHURCHILL, NEW BURLINGTON STREET

1880

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COLLEGE OF WESTERN

D Blair ad nat. del. et lith.

M & N Hanhart imp.

CYTISUS SCOPARIUS, *Link.*

N. Ord. LEGUMINOSÆ. Lindl., Veg. K., p. 544 (*Fabaceæ*); Baill., Hist. Pl., ii; Le Maout & Dec., p. 365.

Tribe *Genisteæ*.

Genus Cytisus,* *Linn.* B. & H., Gen., i, p. 484; Baill., Hist. Pl., ii, p. 334. Species about 40, natives of Europe, N. Africa, and Western Asia.

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70. Cytisus scoparius,† *Link, Enum.*, ii, *p.* 241 (1822).

Broom.

Syn.—Spartium scoparium, *Linn.* Genista scoparia, *Lam.* Sarothamnus vulgaris, *Wimm.* S. scoparius, *Koch.*

Figures.—Woodville, t. 150; Steph. & Ch., t. 67; Hayne, ix, t. 10; Curt., Fl. Lond., fasc. 5; Syme, E. Bot., iii, t. 329; Le Maout and Dec., p. 311.

Description.—A bush of 4 or 5 feet in height, with a short stem reaching about $1\frac{1}{2}$ inches in diameter, breaking up into very numerous erect branches, bark yellowish-green. Twigs very long and wand-like, erect, tough, blunt at the ends, which are pubescent and grow till killed back by the frost, dark-green, angular, with 5 prominent wings of leaflike character originating from the sides of the attachment of each leaf and passing down between them. Leaves alternate, evidently pentastichous, without stipules, small, the lower ones on longish flat stalks, trifoliate, the upper ones sessile, unifoliate, and apparently simple, leaflets sessile $\frac{1}{4}$—$\frac{1}{2}$ inch long, lanceolate or narrow obovate, subacute, entire, dark green and smooth or slightly hairy above, hairy below. Flowers numerous, large, solitary, on rather long smooth stalks in the axils of the sessile leaves, forming lax racemes. Calyx campanulute, laterally compressed, smooth, persistent, divided into 2 brown, scarious, shallow lips, the upper 2-, the lower 3-toothed. Petals 5, papilionaceous, wide-spreading, brilliant yellow, standard roundish, with a short claw, notched, the margin somewhat involute, wings oblong, keel

* *Cytisus*, in Greek κύτισος, the classical name for some leguminous shrub.

† *Scoparius*, a mediæval adjective, from *scopæ*, a broom.

as long as wings, blunt, at length turned downwards. Stamens 10, inserted at the base of the calyx, the filaments all united for some distance into a closed tube, their ends free, the 5 longer alternating with the 5 shorter, curved upwards, anthers small, 5 versatile and 5 sub-basifixed. Ovary sessile, compressed laterally, with dense silky hairs along each edge, style long, much curved upwards or even coiled into a ring, smooth, stigma terminal. Pod about $1\frac{1}{2}$ inches long, oblong or linear-oblong, curved or nearly straight, with an apiculus at the end, much flattened, dark brown, smooth on the sides, with a fringe of long white hairs along the edge, valves separating with elasticity and becoming afterwards much twisted, smooth inside. Seeds about 12—18 in the pod, nearly sessile along the upper (ventral) suture, oblong-ovoid, slightly compressed, smooth and shining, olive-coloured, hard, the short funicle dilated into a thick two-lobed mass (strophiole) over the hilum; radicle thick, incumbent; endosperm scanty.

Habitat.—This familiar and beautiful shrub is very common throughout this country on heaths and open places, and in woods, often growing in great quantity and forming a marked feature in the vegetation of many sandy districts, especially noticeable in May and June when covered with its brilliant scented flowers. It is found in equal abundance throughout Western Europe, but becomes rare in the central and eastern parts, and in the Mediterranean countries. It, however, occurs in Italy and in Central and Southern Russia, extending even into Siberia.

The five prominent wing-like angles which give so striking a character to the young twigs are remarkably persistent, and can be traced on the very oldest stems; as the stem increases in thickness they become of course more widely separated, and at length appear as distant arching ridges, the summit of each arch marking the point of attachment of a leaf.

A pretty form with prostrate stems spreading in a circle is found on the cliffs of the west of France and England, where they are exposed to the winds and spray of the Atlantic Ocean.

A small quantity of endosperm is certainly present as a thin

layer lying on the sides of the cotyledons in the seeds of this species.

About five or six other species are referred to *Sarothamnus*, which is still maintained as a genus distinct from *Cytisus* by many botanists.

Syme, E. Bot., iii, p. 11; Hook. f., Stud. Fl., p. 87; Watson, Comp. Cyb. Br., p. 137; Gren. & Godr., Fl. France, i, p. 348; Ledebour, Fl. Ross., i, p. 515; Lindl., Fl. Med., p. 239; Flück. and Hanb., Pharmacogr., p. 148.

Official Part and Names.—Scoparii Cacumina; the fresh and dried tops of Sarothamnus scoparius, *Wimmer* (B. P.). The fresh and dried tops (I. P.). Scoparius; the tops of Sarothamnus scoparius (U. S. P.).

General Characters and Composition.—Broom tops are branched, straight, angular, dark green, smooth, and tough; their taste is bitter and nauseous; and in a fresh state they have a peculiar odour when bruised, but this is nearly lost in drying.

According to Stenhouse, broom tops contain two peculiar principles; one of which is neutral or somewhat acid, and has been termed *scoparin*, and the other a volatile liquid alkaloid, called *sparteine* or *spartia*. *Scoparin* is described by Stenhouse as crystallizing in stellate tufts of a yellow colour, readily soluble in water or alcohol, and without taste or smell. The experiments of Stenhouse lead to the belief that scoparin is the diuretic principle of broom tops; it does not appear to have any poisonous property. *Spartia* or *sparteine* is a colourless oily liquid at first, but it becomes brown by exposure to light. It is heavier than water, and but sparingly soluble in it; it is distinctly alkaline in its reactions, and forms extremely bitter crystallizable salts with acids. Like nicotia and conia it is destitute of oxygen. Stenhouse regarded spartia as a narcotic principle; it is very poisonous. Stenhouse also states that broom grown in the shade contains less spartia than that which flourishes in open sunny places; and he adds that shepherds are well acquainted with the narcotic properties of broom, from noticing that sheep after eating it become excited and stupified.

Medical Properties and Uses.—In large doses broom tops are emetic and purgative; and in small doses diuretic and laxative. Broom tops have long had a popular reputation in this country as a diuretic in dropsical affections; and are also regarded by the regular medical practitioner as one of the most serviceable remedies in such cases, more especially in dropsies depending on heart disease. The use of broom is contra-indicated in acute disease of the kidneys.

The seeds have similar properties to broom tops, and may be used in like cases. Scoparin has also been given as a diuretic in repeated doses of five grains; it is said not to produce any injurious effects.

The seeds of an allied plant—*Spartium junceum*, the Spanish Broom—have similar properties to the Common Broom. Its fibres have also been used from an early period in some parts of Southern Europe for cordage, and in the manufacture of a coarse kind of cloth for home use; and it has lately been much talked of in Italy, and a patent has been taken out for preparing the fibre.

Per. Mat. Med., by B. & R., p. 833; Pharmacographia, p. 149; U. S. Disp., by W. & B., p. 793; Gmelin's Chem., vol. xvi (1864), p. 282; Stenhouse, in Phil. Trans., 1851, pp. 422—431; Pharm. Journ., vol. ii, ser. 1, p. 36.

DESCRIPTION OF PLATE.

Drawn from specimens collected in the Isle of Wight by Mr. Stratton, and at Battersea, Surrey.

1. A flowering branch.
2. The standard.
3. Wing.
4. Keel.
5. Flower with the petals removed.
6. Pistil.
7. Diagram of flower.
8. A pod.
9. The same with the valves separated.
10. Seed.
11. Section of the same.

(10, 11, enlarged.)

T. Blair ad nat. del. et sc.

M. & N. Hanhart imp.

TRIGONELLA FOENUM-GRÆCUM, *Linn.*

N. Ord. LEGUMINOSÆ.

Tribe *Trifolieæ.*

Genus Trigonella,* *Linn.* B. & H., Gen., i, p. 486; Baill., Hist. Pl., ii, p. 290. Species about 50, chiefly inhabitants of S. Europe, N. Africa, and Asia Minor.

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71. Trigonella Fœnum-græcum,† *Linn., Sp. Plant., ed.* 1, *p.* 777 (1753).

Fenugreek.

Syn.—Fœnum-græcum officinale,

Figures.—Woodville, t. 154; Hayne, viii, t. 141; Nees, t. 325; Berg, Charact., t. 66, fig. 503; Flora Græca, t. 766.

Description.—An annual herb 1—2 feet high, with an erect, slightly branched, cylindrical, hollow, smooth or slightly pubescent stem; root tapering. Leaves alternate on rather long stalks, trifoliolate, stipules ¼ inch long, triangular-acuminate, entire, ciliate, leaflets shortly stalked, articulated to the rachis, oblong-obovate, blunt or emarginate at the apex, denticulate in the upper half, glabrous. Flowers sessile, solitary (rarely 2) in the axils of the leaves. Calyx long and narrow, divided about half way down into 5 narrowly lanceolate or linear acuminate teeth, hairy outside, pale green. Corolla papilionaceous, about twice as long as the calyx, pale yellow, standard about ¾ inch long, with a narrow claw and an ovate emarginate blade, wings much shorter, blunt, lower petals united in front to form a very blunt rounded keel shorter than the wings. Stamens 10, free from the corolla, hypogynous, the uppermost filament distinct, the other 9 combined except at their curved-up extremities, to form a sheath round the pistil, open above; anthers very small, similar. Ovary smooth or downy, with numerous ovules, style rather long, some-

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* *Trigonella*, from the triangular form of the flowers of *T. ruthenica*, L., the type of the genus.

† *Fœnum-græcum*, the name employed by Columella for this plant; in Greek, τῆλις and βούκερως.

what falcate, stigma capitate. Pod 5 to 7 inches long by $\frac{1}{6}$ to $\frac{1}{4}$ inch wide, erect when young, afterwards bent downwards, somewhat curved in a falcate manner, much laterally compressed, smooth, veined with a few longitudinal anastomosing nerves, surrounded at the base by the persistent calyx, gradually tapering at the apex into a long, slender beak, frequently capped by the withered corolla which has been carried on by the growth of the fruit. Seeds 10—20 in the pod, on long funicles, compressed, obliquely rhomboid, nearly $\frac{1}{4}$ inch long, pale orange, slightly rough, with a deep oblique furrow across the upper part; cotyledons plane-convex, radicle very large, doubled down on the edges of the cotyledons (accumbent); no endosperm.

Habitat.—A native of the East, including Thessaly, many parts of Asia Minor, and Persia. By cultivation it has spread through the Mediterranean region and Central Europe, and also into Egypt, Abyssinia, and India. It is now less used as a forage plant than formerly, but is still cultivated in the South of France, Morocco, Egypt, and India. The plant has a strong and characteristic smell, especially when dried.

If the seeds are placed in water, the inner seed-coat swells up into a thick mucilage and bursts the testa.

DC. Prod., ii, p. 182; Gren. & Godr., Fl. France, i, p. 397; Boissier, Fl. Orient., ii, p. 70; Oliver, Fl. Trop. Africa, ii, p. 70; Lindl., Fl. Med., p. 239.

Part Used and Name.—Fœni-Græci Semen; the seed. It is not official in the British Pharmacopœia, or the Pharmacopœia of India, or the Pharmacopœia of the United States. They were, however, formerly official in our pharmacopœias.

General Characters, Commerce, and Composition.—Fenugreek seeds of commerce are small, hard, angular, somewhat compressed, often more or less shrivelled, and with a light brown or brownish-yellow colour externally, and yellow internally. They have a somewhat oily and farinaceous taste, accompanied by a slight bitterness, and feeble melilot flavour; and a strong, peculiar odour, which is also suggestive of melilot, or of coumarin. They give

out the whole of their odour and taste to alcohol; and form when boiled with water a thick slimy mucilage.

The seeds are chiefly exported to Europe from Egypt and India, where they are produced on a large scale. In Egypt, fenugreek is known by the Arabic name *Helbeh*, and in India under the Sanskrit name of *Methi*.

The principal constituents of the seeds are about 28 per cent. of *mucilage*, which is contained in the tissue investing the embryo; 6 per cent. of a slightly bitter fœtid *fatty oil*; a little *tannic acid*; and a *yellow colouring* matter. The seeds yielded to Jahns, from experiments performed in Dr. Flückiger's laboratory, 3·4 per cent. of nitrogen, equivalent to 22 per cent. of *albumin*. The nature of the odorous principle is unknown.

Medical Properties and Uses.—The use of fenugreek as a medicinal agent is now obsolete in Europe and the United States; but in India the seeds are largely employed by the natives, both as food and medicine; whilst the fresh plant is consumed as a vegetable. In Alexandria also the seedlings are eaten as a great delicacy.

Formerly the seeds were employed in the preparation of emollient cataplasms, fomentations, and enemata; but were never given internally. The powdered seeds are still used in this country and elsewhere in veterinary practice; as an ingredient of curry powder; and for flavouring, &c., the patent so-called concentrated Cattle Foods. They are also said to be employed to render damaged hay palatable.

Woodville's Med. Bot. (1793), vol. iii, p. 438; Miller's Gard. Dict., vol. ii, part 2; Gerarde's Herball., by Johnson (1636), p. 1196; Lindley & Moore's Treasury of Botany (1866), part 2, p. 1170; Pharmacographia, p. 150; Jackson, in Gardeners' Chronicle, July 29, 1876.

DESCRIPTION OF PLATE.

Drawn from a specimen in Kew Gardens, flowering in July. 1. Upper part of the plant. 2, 3. Standard. 4. Wing. 5. Keel of corolla. 6. Section of calyx and ovary. 7. Staminal sheath spread open. 8. Ripe pod. 9, 10. Seed. 11. Vertical, and—12. Transverse section of the same. 13. Embryo. (2–7, 11, 12 enlarged.)

D.Blair F.L.S. ad nat. del. et lith.

INDIGOFERA TINCTORIA, *Linn.*

M & N.Hanhart imp.

N. Ord. LEGUMINOSÆ.

Tribe *Galegeæ*.

Genus Indigofera,* *Linn.* B. & H., Gen., i, p. 494; Baill., Hist. Pl., ii, p. 277. A large genus of over 250 species, natives chiefly of tropical countries in both Worlds, and especially abundant in Africa.

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72. Indigofera tinctoria, *Linn., Sp. Plant., ed.* 1, *p.* 751 (1753).

Indigo. Nil, Neel (Bengal).

Syn.—I. indica, *Lam.*

Figures.—Berg & Sch., t. 30 d; Rheede, Hort. Malab., i, t. 54; Wight, Ic. Plant. Ind. Or., t. 365.

Description.—A small shrub, 4—6 feet high, with slender, spreading, rather angular branches, rough with short adpressed white hairs. Leaves alternate, 3 or 4 inches long, shortly stalked, unequally pinnate, with small, setaceous stipules, rachis stiff, tapering, hairy; leaflets in 4 to 6 opposite pairs and an odd one, very shortly stalked, each with a minute stipella at the base, oval- or obovate-oblong, entire, $\frac{1}{2}$—$\frac{3}{4}$ inch long, glabrous and blueish green above, silky with white adpressed hairs and paler beneath. Flowers small, shortly stalked, rather closely arranged in erect, tapering spicate stalked racemes from the axils of the leaves and shorter than them, rachis silky, bracts subulate. Calyx sub-bilabiate, when in full flower almost flat, silky externally, cut into 5 nearly equal triangular teeth, the two upper erect. Petals papilionaceous, the standard oval, obtuse, erect, greenish, wings oblong-spathulate, pink, keel petals about as long as the wings, united except the long claws, with a backward spur on the sides, pinkish with green veins. Stamens 10, the upper one distinct, the others united into a sheath. Ovary sessile, linear, downy, stigma capitate. Pod linear, 1—1$\frac{1}{2}$ inch long, cylindrical, slightly falcate, apiculate, drooping, somewhat constricted between the

* *Indigofera*, given to the present species by Linnæus, from affording Indigo. This is a mediæval word corrupted from the Latin *Indicum*, which referred to the country of its origin.

seeds, smooth or slightly pubescent, dark brown, 2-valved, with several (8—12) seeds separated by partitions. Seed somewhat quadrangular with truncate ends, smooth, dark brown, embryo with flat cotyledons and an accumbent radicle, in the axis of rather scanty endosperm which lies especially over its sides.

Habitat.—The native country of this species is not known with certainty; but it is considered to be indigenous in Senegal and other parts of West Tropical Africa. It is common, apparently wild, in all parts of India, but never far from where cultivated; there seems to be no good reason, however, for denying it to be a native in Asia. Its cultivation is carried on in India on a scale of great magnitude, and can be effected up to the elevation of 2000 feet in the Punjaub; though naturally a shrub, it is grown as an annual or biennial. Indigo is also grown extensively in Tropical Africa, Tropical America, &c. Examples may be seen in our botanic gardens at Kew, Chelsea, and the Regent's Park.

Some other species of this large genus are also cultivated for Indigo. *I. argentea*, Linn. (*I. cœrulea*, Roxb.), certainly a native of India and figured in Wight's Icones, t. 366, is grown in North Africa and Arabia; and *I. Anil*, Linn., which is thought to be of West Indian origin (Jamaica), is cultivated in some parts of India and Tropical Africa.

Indigo is yielded by plants of other families; *Isatis tinctoria*, Linn., the Woad, a native of Europe and perhaps of England where it is rare, is a Cruciferous plant; and *Polygonum tinctorium*, Linn., of China, belongs to the Polygonaceæ.

Roxb., Fl. Ind., iii, p. 379; Fl. Brit. India, ii, p. 99; Brandis, Forest Flora, p. 135; Fl. Trop. Africa, ii, p. 99; Lindl., Fl. Med., p. 242.

Official Part and Name.—Indigo; a blue pigment prepared from various species of Indigofera (B. P. *Appendix*). Indigo (I. P). It is not official in the Pharmacopœia of the United States.

Preparation.—For preparing indigo the plants are cut down in June and July, just before the process of flowering, placed in troughs,

and after being pressed closely together they are covered with water. Fermentation then takes place and is allowed to continue from twelve to fifteen hours, when the body of the liquid acquires a sherry colour, and the surface becomes covered with a blue film. It is then decanted, and the colouring principle dissolved by the water, absorbing oxygen from the air, becomes insoluble, and is gradually precipitated as a deep blue granular powder. This precipitation is facilitated by brisk agitation of the liquid, or by the addition of lime-water, or an alkaline solution. The supernatant liquor is then drawn off, and the sedimentary matter after being heated is thrown upon a calico filter, where it is washed, and the indigo afterwards removed from the filter, pressed and cut usually into cubical cakes, and lastly dried, and sent into the markets. The indigo thus obtained does not exist readily formed in the plant, but is generated in the process adopted for its preparation by a kind of fermentation from a principle, which, has been called by Schunck, its discoverer, *indican*.

Commerce.—Indigo is chiefly imported from the East Indies; but also from Guatemala and the northern parts of South America.

General Characters and Composition.—Indigo, which is also called *indigo-blue* and *indigotin*, is usually found in cubic cakes of a deep blue colour, which when rubbed by a smooth hard body, as the nail, assumes a coppery or bronze hue. Commercial indigo only contains from 50 to 60 per cent. of pure *indigotin*, the remainder consisting of *indigo-red*, *indigo-brown*, *indigo-gluten*, and a number of brown resinous products, &c., which are either formed directly from the indican itself, or from the decomposition of the indigo-blue. Deoxidating agents destroy the blue colour of indigo by abstracting oxygen, by which it is converted into *white indigo* or *indigogen*; this is soluble in water, while indigotin is not, and the solution by exposure to the air again attracts oxygen, and the indigogen is again reconverted into indigo-blue. Advantage is taken of this property to purify commercial indigo, by resorting to the process of the vat, which consists in converting the indigo-blue into indigo-white, by the

action of deoxidating agents as protosulphate of iron, and subsequently reoxidising it.

Indigo is odourless and tasteless when pure. It is insoluble in water, cold alcohol, ether, dilute acids and alkalies, and in cold fixed and volatile oils. Hot alcohol and fixed oils, however, dissolve it in small quantities, but again deposit it on cooling; the best solvents are, however, aniline and nitro-benzol. Chlorine and the hypochlorites destroy the blue colour of indigo. Heated with sulphuric acid it forms a deep blue liquid, which is commonly termed sulphate of indigo; this is a solution of *sulphindylic acid* which is produced during the process.

Medical Properties and Uses.—Indigo has been introduced into the British and Indian Pharmacopœias solely for the preparation of a solution of Sulphate of Indigo, which is employed as a test for free chlorine in liquor sodæ chloratæ and hydrochloric acid, as the colour of the solution is destroyed by free chlorine.

Indigo has been used as a remedial agent in epilepsy, and also in infantile convulsions, chorea, hysteria, and amenorrhœa. It appears to act as an irritant to the alimentary mucous membrane; and under its influence the urine becomes green or blueish-green. It has now nearly, or entirely, gone out of use, for when given in sufficient doses to produce a desirable effect it is said to cause the most distressing nausea. It seems, however, a remedy worthy of some further trials. Indigo is in certain cases found in the urine in disease.

Per. Mat. Med., vol. ii, pt. 2, p. 330; Per. Mat. Med., by B. & R., p. 835; U. S. Disp., by W. & B., p. 1618; Watts, Dict. Chem., vol. iii, p. 250; Royle, Mat. Med., by Harley, p. 657; Schunck, in Pharm. Journ., ser. 1, vol. xv, p. 166; Hassall, in Pharm. Journ., vol. xiii, ser. 1, p. 219, from Proceedings of the Royal Society, vol. vi, No. 97; Year Book of Pharmacy for 1871, p. 322, and Year Book of Pharmacy for 1872, p. 254.

DESCRIPTION OF PLATE.

Drawn from a plant cultivated in Kew Gardens. The fruit added from an Indian specimen in the British Museum. 1. A branch with flowers. 2. A flower. 3. The same with the petals removed. 4. The standard. 5. A wing-petal. 6. A keel-petal. 7. The carina. 8. Pistil. 9. Raceme of pods. 10. A pod. 11. A seed. 12, 13. Vertical, and—14. Transverse section of the same. (2–8, 10–14 enlarged.)

J. Bauer F.L.S. ad nat. del. et lith.

M & N Hanhart imp.

ASTRAGALUS GUMMIFER, *Labill.*

N. Ord. LEGUMINOSÆ.

Tribe *Galegeæ*.

Genus Astragalus,* *Linn.* B. & H., Gen. i, p. 506; Baill. Hist. Pl., ii, p. 208. One of the largest genera. Over 1000 species have been described, natives especially of warm and temperate Asia, Europe, and America. Absent from Australia and S. Africa.

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73. Astragalus gummifer,† *Labill. in Observ. sur la Physique, &c.*, xxxvi, *p.* 59 (1790).

Tragacanth. *Guini* (Kurdish).

Syn.—A. erianthus, *Willd.*

Figures.—Observ. sur la Phys., xxxvi, t. i, cop. in Hayne, x, t. 8, and Nees, Suppl.

Description.—A small shrub about 2 feet in height, with a short naked stem and very numerous, straggling, much ramified branches, bark reddish-grey, slightly rough, and marked with the scars of the leaves, the young twigs covered with close white wool. Leaves very numerous, closely placed, spreading in all directions, about $1\frac{1}{4}$ inch long, pinnate, the rachis very hard, stiff, smooth, yellow, terminating in a very sharp point, and persistent for some years as a woody spine, furnished at the base with rather large, membranous, broad, acute, glabrous, rufous, stipules embracing the stem and becoming lacerated at the margin; leaflets opposite or alternate, in 4—6 pairs, nearly sessile, very small, about $\frac{1}{8}$ inch long, obovate-oval or oblong-acute, usually somewhat conduplicate, entire, glabrous on both sides, greyish-green, strongly veined, articulated with the rachis and quickly deciduous. Flowers small, sessile, solitary or 2 or 3 together, closely placed in the axils of the lower leaves, each with a

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* *Astragalus*, ἀστράγαλος, the classical name of some small, shrubby, Leguminous plant.

† The author of the species writes *gummifera*, but it is now customary to make *Astragalus* masculine.

membranous, ovate, acute bract about as long as the calyx, with a central nerve. Calyx very deeply divided almost to the base into 5 equal, very narrow, acute segments, densely covered with long, silky, snow-white hairs, persistent but not inflated in fruit. Petals papilionaceous, not much exceeding the calyx, pale yellow, persistent; standard oblong, blunt or emarginate, dilated below and rolled into a tubular sheath, wings a little shorter than the standard, with a very long linear claw, keel-petals nearly as long as the wings, united throughout to form a blunt carina. Stamens 10, the upper one free, the rest united to form a sheath, which is adnate to the petals at the base. Ovary densely villous, style long, filiform, glabrous, stigma minute, terminal. Pod very small, rounded-oblong, densely covered with white hairs, 1-seeded. Seed small, somewhat reniform, smooth, pale brown.

Habitat.—The source of Tragacanth had been known for centuries to be some of the spiny species of *Astragalus* growing in Asia Minor, but the present plant was the first satisfactorily determined and described. This was done by the French botanist Labillardiere in 1790, who collected it on the Lebanon range. It grows there abundantly at a considerable elevation, and is also met with on Mount Hermon and on the mountains of several other parts of Asia Minor, Armenia, and Northern Kurdistan; having a larger range than most of its allies. But besides *A. gummifer* there are many other allied species of this vast genus which afford Tragacanth. The principal of these are, according to Hanbury, the following:—*A. eriostylus*, Boiss. & Haussk., *A. adscendens*, Boiss. & Haussk., *A. brachycalyx*, Fisch., *A. pycnoclados*, Boiss. & Heldr., *A. microcephalus*, Willd. (*A. eriocaulos*, DC.), *A. stromatodes*, Bunge, *A. kurdicus*, Boiss., *A. cylleneus*, Boiss. & Heldr.

All these species are natives of mountainous districts in the East; Asia Minor, Armenia, Persia and Kurdistan, Syria, and Greece; descriptions and localities will be found in Boissier's 'Flora Orientalis,' vol. ii, but no figures of any of them have been published.

A. verus, Olivier (figured in his 'Voyage Emp. Oth.,' v, t. 44, cop. in Hayne x, t. 7, and Nees, t. 329), was found in Persia, and stated by its discoverer to be a great source of Tragacanth. The species has not, however, been met with by any one since.

A. creticus, Lam. (figured in Steph. and Ch., t. 161; Berg and Sch., t. 31 d; Flora Græca, t. 736), which is a native of Greece and Crete, is said to afford a small quantity of the gum.

The *A. Tragacantha* of Linnæus was unfortunately named; it yields no Tragacanth. This species is found in the South of Europe, and does not occur in the East.

These all belong to the section or subgenus *Tragacantha*, which contain a very large number of species, 156 Oriental ones being described in the 'Flora Orientalis.'

Labillardière, loc. cit., pp. 46—53; DC., Prod., ii, p. 296; Bunge, Astrag. Sp. Gerontog., p. 146; Boiss., Fl. Orient., ii, p. 318; Lindl., Fl. Med., p. 247; Flück. & Hanb., Pharmacogr., p. 151.

Official Part and Name.—TRAGACANTHA; a gummy exudation from the stems of Astragalus verus, *Olivier*, and possibly other species (B. P.). A gummy exudation from the stem (I. P.). TRAGACANTHA; the gummy exudation from Astragalus verus, *Olivier*, and from other species of Astragalus (U. S. P.). The researches of Professor Haussknecht, of Weimar, and others, since the publication of the British Pharmacopœia, have now clearly proved that commercial Tragacanth is the produce of several species of Astragalus, the more important of which we have noticed in our botanical description.

Formation, Production, and Commerce.—It was first shown by Mohl, and subsequently by Wigand, that tragacanth is not, as was previously supposed, simply the juice of the plants yielding it, dried by exposure to the air; but that its formation is owing to a more or less complete transformation of the cells of the pith and medullary rays of the stem into a mucilaginous mass. This is proved, not only by microscopical examination, but also by the fact, that the pith and medullary rays of the younger branches present no such structure, but simply that of ordinary parenchymatous tissue. Tragacanth is therefore properly designated as a

degradation-product. The tension under which this peculiar transformed tissue is held in the interior of the stem is, according to Hanbury, very remarkable in *Astragalus gummifer*, Labil., as he had the opportunity of observing on Mount Lebanon in 1860. Thus, he says, "On cutting off a branch of the thickness of the finger there immediately exudes from the centre a stream of soft, solid tragacanth, pushing itself out like a worm, to the length of $\frac{3}{4}$ of an inch, sometimes in the course of half an hour; while much smaller streams (or none at all) are emitted from the medullary rays of the thick bark." This oozing out of tragacanth is also well seen in one of Hanbury's specimens of *A. gummifer*, in his Herbarium in the Museum of the Pharmaceutical Society. The pressure which is thus exerted by the surrounding tissues on the tragacanth as it exudes, accounts in some degree for the peculiar forms in which it occurs in commerce.

Tragacanth is produced in various parts of Asia Minor, Syria, Armenia, Kurdistan, and Persia. Tragacanth exudes naturally from the stem of the species of Astragalus yielding it, but the finest tragacanth—the white flaky kind—is derived from incisions made into the stem. The mode of obtaining it is thus described by Maltass:—"In July and August the peasants clear away the earth from the lower part of the stem of the shrub, and make several longitudinal incisions with a knife in the bark; the gum exudes the whole length of the incision, and dries in flakes; three or four days are sufficient for this purpose, and the gum is then collected. In some places also the peasants occasionally puncture the bark with the point of the knife. If the weather be hot and dry, the gum is white and clean; but if the atmosphere be damp and the heat but moderate, the gum acquires a longer time to dry, and assumes a yellow or brown tinge." At the same time that the peasants collect the flaky tragacanth, they also pick off the gum which exudes naturally, and this chiefly constitutes the commoner sorts of commercial tragacanth. In Persia and Kurdistan, according to Professor Haussknecht, the tragacanth which is collected is principally the spontaneously exuded gum.

The principal market for tragacanth is Smyrna, where it is brought from the interior by the dealers who purchase it from the peasants. When it arrives in Smyrna tragacanth is a very mixed product, and, therefore, to fit it for the requirements of the European markets, it is separated by picking and sorting into different qualities, such as *Flaky or Leaf Gum, Vermicelli,* and *Common or Sorts.* The kinds of tragacanth thus imported from Smyrna are commonly known as *Smyrna Tragacanth;* but some is also shipped from Constantinople. Some tragacanth is also derived by way of Bagdad and the Persian Gulf, and is the produce of Kurdistan and Persia. This is incorrectly known in commerce as *Syrian Tragacanth.*

General Characters and Varieties.—Tragacanth is commonly termed *gum dragon.* The *best or flaky tragacanth,* namely, that that which is produced by incision, and which alone corresponds to the official description in the British Pharmacopœia, is in thin, irregularly oblong or roundish, leaf-like or flaky pieces, which are white or yellowish in colour, 1 to 3 or more inches in length, and from $\frac{1}{4}$ to 1 inch in width. Flaky Tragacanth is also sometimes found of much larger size. Thus, in the Museum of the Pharmaceutical Society of Great Britain some pieces may be seen which are several inches in length, as much as 2 inches wide, $\frac{3}{10}$ of an inch thick, and weighing nearly 3 ounces. The pieces are usually somewhat curved, and marked on the surface by a series of arched or concentric elevations, which represent the boundaries of the successive flows of gum which have been forced out in a soft state and subsequently hardened. The flaky tragacanth which is incorrectly known as Syrian Tragacanth, because, as already stated, it is the produce of Persia and Kurdistan, is distinguished from the Smyrna or ordinary flaky tragacanth, by being somewhat more translucent, and without its yellow tinge.

The gum which has *exuded spontaneously* is generally in pieces from the size of a pea upwards; these are brownish or yellowish in colour, of a dull somewhat waxy appearance, and rounded or botryoidal in form. This constitutes the *Common* or *Sorts* of com-

merce. Some of the exuded gum is also in pieces of variable thickness, which are more or less contorted and vermiform. This is distinguished as *Vermicelli tragacanth.* Some of this latter is, however, doubtless produced from artificial punctures. The best flaky and vermicelli tragacanths are of a dull white colour, translucent, somewhat flexible and horny, tough, not readily broken or powdered, odourless, and almost tasteless. When dried, however, at about 120°, so as to drive off their contained water, they are more readily pulverisable. The inferior kinds of tragacanth are more or less coloured, and usually contaminated with various impurities, as bark, earthy, and other foreign bodies.

Adulterations.—The large flaky tragacanth and the other kinds of tragacanth in which the pieces are large, are not liable, so far as we know, to adulteration ; but the small and inferior vermicelli tragacanth and the common or sorts are frequently mixed with other gums. Thus, at Smyrna, according to Maltass, tragacanth is adulterated with two other gums collected in Caramania and Armenia, and termed respectively *Caramania* and *Moussul gums.* The latter is regarded by Hanbury as very inferior tragacanth, but the origin of the former is doubtful. It is conjectured to be the exudation of almond and plum trees, although some believe that a portion of it, at least, is *Kuteera gum,* which is derived from *Sterculia urens.* Caramania gum is found in nodular masses of a dull brownish colour, which for the purpose of adulteration, in order to render it more difficult of detection, are broken into small angular fragments of different sizes so as to adapt it for the adulteration of tragacanth of corresponding dimensions ; it is also whitened previous to mixing with white lead. With ordinary care, however, caramania gum is easily detected by its angular appearance, as no pieces of tragacanth present such a character. The presence of lead may be proved by the usual reagents for that substance. Caramania gum is also known in the London market as *Gum Bassora* or *Hog Gum Tragacanth.*

Composition.—Tragacanth appears to be composed of two distinct principles, one soluble in water, and resembling the arabin of gum acacia ; and the other swelling in water, but not

dissolving. The former, which is sometimes termed *soluble gum* or *arabin of tragacanth,* differs, however, in some respects, from the arabin of gum acacia. Thus, amongst other characters, as noticed by us under the head of 'Acacia Senegal,' no precipitate is formed in a solution of gum acacia by the neutral acetate of lead, whilst a solution of tragacanth yields an abundant precipitate under the same circumstances. The other constituent has been termed *traganthin* or *adraganthin* and *bassorin.* According to Girard, tragacanth contains more than half its weight of a pectic principle insoluble in water, and probably identical with Frémy's pectose. When tragacanth is immersed in water it swells, and ultimately disintegrates and forms a thick mucilage.

Medical Properties and Uses.—Tragacanth possesses emollient and demulcent properties. It is, however, used in medicine, not so much for its own effects, but rather as a vehicle for more active and heavy medicines. Thus, in the form of a mucilage it may be employed to suspend calomel and other heavy powders in water. The compound powder of tragacanth is also a good vehicle for the administration of calomel, &c., to children. Mucilage of tragacanth has likewise been recommended as an application to burns. Tragacanth is also valuable for imparting consistence to lozenges and pill masses.

Tragacanth is likewise employed by manufacturers for stiffening crape, calico, &c.

Per. Mat. Med., vol. ii, pt. 2, p. 320; Pharmacographia, p. 152; U. S. Disp., by W. & B., p. 873; Maltass, in Pharm. Journ., vol. xv, ser. i, p. 18; Mohl. Botanische Zeitung (1857), p. 33, and Pharm. Journ., vol. xviii, ser. 1, p. 370; Wigand, in Pringsheim's Jahrbücher f. Wissenschaftl. Botanik., 3 (1861), 117; Journ. de Pharm., Feb., 1856, p. 117, and Feb., 1857, p. 149; Proc. Amer. Pharm. Assoc., vol. xxiii, p. 361, from Chem. News, April 2, 1875, p. 150, and Compt. Rend., Feb. 22, 1875.

DESCRIPTION OF PLATE.

Drawn from a specimen in the herbarium of the late D. Hanbury, collected by him on Mount Lebanon in 1860. 1. A branch with flowers. 2. Bract. 3. Calyx. 4. Petals. 5. Stamens. 6. A pod. 7, 8. Seed. 9. A leaf. (2–6, 8, 9 enlarged.)

M & N. Hanhart imp.

N. Ord. Leguminosæ.

Tribe *Galegeæ ?*

Genus Glycyrrhiza,* *Linn.* B. & H., Gen., i, p. 508; Baill., Hist. Pl., ii, p. 282. Species 14, natives of warmer temperate countries in both Old and New Worlds.

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74 Glycyrrhiza glabra, *Linn., Sp. Plant., ed.* 1, *p.* 742 (1753).

Liquorice.

Syn.—Liquiritia officinalis, *Moench.* G. glandulifera, *W. & K.* G. violacea, *Boiss.*

Figures.—Woodville, t. 152; Hayne, vi, t. 42; Nees, t. 327; Steph. & Ch., t. 134; Berg & Sch., t. 12f; Flora Græca, t. 709; Nees, Gen. Fl. Germ.

Description.—A perennial herb with a thick rootstock passing below into long, straight, cylindrical, slightly tapering, smooth, flexible, slightly branched roots, about ½ inch in diameter, red or orange-brown on the surface, pale yellow within, and giving off at the top long horizontal subterranean stolons. Stems several from the crown, 2—4 feet or more high, erect, stiff, solid, strongly striate, shortly pubescent, branched. Leaves alternate, spreading, large, stalked, with very minute deciduous stipules, imparipinnate, leaflets opposite in 4—7 pairs and a terminal one, shortly stalked, oblong-oval or -ovate, obtuse, entire, smooth, except when young, dark green on both sides, glutinous beneath; rachis stout, not furrowed, thickened below. Flowers very shortly stalked, arranged in a rather lax, erect raceme, which is 1—3 inches long and long-stalked, but falling short of the leaves; bracts linear, acute, scarious, brown. Calyx tubular, cut about half way down into 5 unequal teeth, the lowest one longest, the upper two connate, pubescent and glandular, green. Petals papilionaceous, pale lilac, the wings darker; standard oblong-oval, blunt, erect, with a claw, wings falcate-oblong, ascending, shorter than the standard, keel-petals quite

* *Glycyrrhiza*, γλυκυρρίζα, of Dioscorides, the classical name. *Liquiritia* and Liquorice are corruptions.

distinct, a little shorter than the wings and slightly locked with them. Stamens 10, 9 united into a sheath, the vexillary one free, anther-cells confluent at the top. Ovary sessile with several ovules, stigma capitate. Pod about 1 inch long, linear-oblong, compressed, somewhat contracted between the seeds, thickened at the edges, pointed, smooth, pale brown, indehiscent, containing 2—5 seeds. Seeds roundish-quadrangular, compressed, about $\frac{1}{8}$ inch wide, smooth, dark brown, testa thick, radicle accumbent; no endosperm.

Habitat.—A native of the warmer parts of the Mediterranean region, North Africa, Spain, Italy, Dalmatia, Greece, and Syria, and extending also to the Danubian provinces, South Russia, and Songaria, and to Asia Minor, Persia, and Affghanistan. It is cultivated in Italy, France, Russia, Germany, Spain, China, &c.; also to a small extent in this country, where, however, the plant is said not to produce seed. Its growth in England dates from the middle of the 16th century, and is now carried on near Pontefract, in Yorkshire, and at Mitcham.

There are several well-marked varieties. In that called *glandulifera* the pods are covered with thick glandular spines.

G. echinata, Linn., a native of Hungary, South Russia, and Asia Minor, is figured in Hayne, vi, t. 41, Nees, t. 328, and Berg and Sch., 12 c, being the official German species. It has short globular heads of flowers and a small ovoid pod with long spines.

Willk. & Lange, Prod. Fl. Hisp., iii, 290; Ledebour, Fl. Ross., i, p. 565; Boiss., Fl. Orient., ii, p. 202; Lindl., Fl. Med., p. 243.

Official Parts and Names.—1. Glycyrrhizæ Radix; the root or underground stem, fresh and dried: 2. Extractum Glycyrrhizæ; the extract of the root (B. P.). 1. The root or underground stem: 2. Extractum Glycyrrhizæ; the extract of the root (I. P.). 1. Glycyrrhiza; the root: 2. Extractum Glycyrrhizæ; the extract of the root (U. S. P.).

1. Glycyrrhizæ Radix.—*Preparation and Commerce.*—The perennial downward running roots, as well as the long horizontal

stolons which they throw off below the surface of the earth, are equally preserved for use. After being dug up, the roots are washed, trimmed, and sorted, and then either sold fresh in their entire state, or cut into short lengths, and dried for sale. In the latter case, the cortical portion is sometimes first removed by scraping.

The liquorice root used in this country is either of home growth, or imported from Germany, Russia, and Spain. That used in the United States is principally derived from Sicily, Italy, and Germany.

General Characters and Varieties.—The varieties commonly distinguished in Great Britain are *English*; *Spanish, Tortosa,* or *Alicante;* and *Russian Liquorice Root.* The latter kind is said to be derived from the variety *glandulifera* of *Glycyrrhiza glabra;* the first two from the variety *typica* of the same plant.

English Liquorice Root is found both in a fresh and dried state. In the former condition it is in long cylindrical pieces, of a bright yellowish-brown colour when washed, very flexible, easily cut, internally yellow and juicy, and consisting of a thick cortical portion, surrounding a central woody axis. It has a peculiar, earthy, somewhat sickly odour; and a strong, peculiar, sweet taste. When *dried,* it is in pieces three or four inches long, about the thickness of the little finger, and either with or without its thin brown coat. In the latter case it is termed *peeled* or *decorticated;* and has a yellowish colour. When unpeeled it has a feebly astringent or somewhat acrid taste combined with the characteristic sweetness of the root, owing to the presence of a little tannic acid, or according to some a resinous oil, in the outer bark; hence the peeled root is to be preferred.

Both *Spanish* and *Russian* Liquorice roots are usually imported in bales or bundles, or rarely, in the case of that portion of the Spanish variety which is derived from Alicante, loose, or in bags. The Spanish Liquorice root is in straight unpeeled pieces, several feet in length, and varying in thickness from a quarter of an inch to about one inch. That from Alicante is frequently untrimmed

and dirty in appearance; but that from Tortosa is usually clean and bright-looking.

The Russian liquorice root which is imported from Hamburg, is either peeled or unpeeled. It is in pieces varying from 12 to 18 inches in length, and from a quarter of an inch to an inch or more, in diameter. Combined with the usual sweetness of liquorice root, this variety has a feebly bitter taste.

Composition.—The principal constituents of liquorice root are *glycyrrhizin*, a *peculiar sugar*, *asparagin*, *starch*, and a little *tannic acid*. According to Robiquet, it also contains a small quantity of a *resinous oil*, to the presence of which the slight acrid taste of the unpeeled root has been attributed, as already mentioned. The peculiar sweet substance termed *glycyrrhizin* or *glycion* is a glucoside, which is resolved by boiling with dilute hydrochloric acid into *glucose*, and a bitter resinous amorphous substance, termed *glycyrretin*. Glycyrrhizin is an amorphous yellow powder, with an acid reaction, and a strong bitter-sweet taste. It is not fermentable; dissolves in hot water, and the solution gelatinises on cooling; it does not reduce an alkaline solution of tartrate of copper when boiled with it.

Medical Properties and Uses.—Liquorice root possesses demulcent properties; and hence is useful to allay cough, and in catarrhal affections. It has also been found serviceable in irritable conditions of the mucous membrane of the urinary organs, &c. But its principal use is as a flavouring adjunct to nauseous medicines, &c. In the form of powder it is likewise employed in the preparation of pills, either to give them proper consistence, or to prevent their adhesion.

2. Extractum Glycyrrhizæ.—*Varieties and Commerce.*—In the British Pharmacopœia there are two extracts of Liquorice official; one soft but solid, the ordinary kind, which is termed Extract of Liquorice; and another which is fluid, and hence called Liquid Extract of Liquorice. In the Pharmacopœia of India, the solid extract is alone official; and in the Pharmacopœia of the United States, the solid extract is placed in the Primary List of the Materia Medica, and the liquid extract amongst the preparations.

Extract of Liquorice is also very largely imported into Great Britain and the United States, from Italy, Spain, France, Asia Minor, and other countries; the largest quantities being derived from Italy. These foreign extracts are known according to the countries or districts whence obtained, as Italian Extract of Liquorice or Italian Juice; Spanish Liquorice or Spanish Juice; &c. The kind most esteemed is manufactured in Calabria, and is termed *Solazzi juice.*

General Characters.—The extract of liquorice as imported, is very different in its characters from the official extracts; the former being hard, dry, and only partially soluble in water; while the latter are either pasty and hygroscopic, or liquid and entirely soluble in cold water. The official extracts are, as a rule, more pure than those which are imported, and hence in the official preparations of the British Pharmacopœia, the latter ought not to be substituted for them.

Extract of liquorice is imported in two forms, that is, either in cylindrical rolls or sticks, or in masses or blocks, the former is termed *stick liquorice,* the latter *liquorice paste.* The former is the kind used as a sweetmeat and in medicine; the latter is principally employed in the preparation of tobacco for chewing and smoking. The sticks vary in size, but are commonly about one inch in diameter, and six or seven inches in length, and when imported are usually wrapped in bay leaves. At one end they are stamped with the maker's name or mark. When pure they are black and dry, and break with a shining conchoidal fracture; they have a peculiar odour, and a strong, sweet, peculiar taste. They are only partially soluble in water, as already noticed; but this undissolved residue does not necessarily indicate adulteration as sometimes supposed; for the extract is purposely so prepared to give the needful firmness to the sticks, and to destroy their otherwise deliquescent properties. Stick liquorice is, however, very commonly impure, either from carelessness in its preparation, or from the fraudulent addition of other substances, such as starch, sand, carbonaceous matter, &c. Small particles of copper are also sometimes found in it, and may even be seen by the

naked eye; these are doubtless derived from the vessel in which the extract has been prepared.

Medical Properties and Uses.—Its properties and uses are similar to those of liquorice root already noticed. It is chiefly used as a flavouring agent in pharmacy; and also largely in the preparation of lozenges, and for sucking as a remedy for coughs, &c. It is also regarded as a sweetmeat by children.

The block liquorice, which is commonly known as Liquorice Paste, is extensively used, as already noticed, in the manufacture of tobacco.

Steph. & Church. Med. Bot., by Burnett, vol. iii, pl. cxxxiv; Per. Mat. Med., by B. & R., p. 836; Pharmacographia, pp. 156 and 159; U. S. Disp., by W. & B., pp. 395 and 433; Journ. de Pharm., Juillet, 1861, p. 72; Pharm. Journ., vol. xvi, ser. i, p. 403, in abstract from Journ. de Pharm., vol. xxx (1856), p. 428; Amer. Journ. Pharm., Sept., 1862, p. 449, and vol. xxviii, p. 225.

DESCRIPTION OF PLATE.

Drawn from a specimen cultivated in Kew Gardens; the fruit added from one from Greece in the British Museum.

1. Top of a flowering plant.
2. A flower.
3. Calyx.
4. Petals.
5. Stamens.
6. Pistil.
7. A pod.
8, 9. Seeds.
10. Sections of the same.
11. Portion of the root and base of stem.

(2–6, 9–10 enlarged.)

M.& N. Benhart imp.

ARACHIS HYPOGAEA, Linn.

N. Ord. LEGUMINOSÆ.

Tribe *Hedysareæ*.

Genus **Arachis**,* *Linn.* B. & H., Gen., i, p. 518. Species 7, 6 Brazilian and 1 found throughout the tropics.

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75. Arachis hypogæa,† *Linn., Sp. Plant., ed.* 1, *p.* 741 (1753).

Ground-nut. Oil-nut. Mundubi (Brazil).

Syn.—Arachis asiatica, *Lour.*

Figures.—Fl. Brasil., Papil., t. 23; Ann. des Sc. Nat., ser. 3, xix, t. 15.

Description.—An annual herb. Stem about a foot or more high, erect, thick, angular, more or less hairy, pale green, with several thick elongated branches which are usually prostrate for a short distance and then ascending sparsely furnished with long spreading hairs. Leaves alternate, long-stalked, with large, stiff, erect, linear, attenuate stipules, adnate for about $\frac{1}{3}$ their length to the petioles, abruptly pinnate, with two pair of opposite leaflets; leaflets 1—2 inches long, broadly oblong-oval or obovate, obtuse, with a small mucro at the apex, entire, slightly thickened at the margin which is ciliate with longish hairs, otherwise nearly smooth. Flowers sessile, several densely crowded together in the axils of the lower leaves, or solitary, each subtended by a stipule-like eared bract about $\frac{1}{2}$ inch long and very acuminate, and each with two small opposite linear smaller bracts beneath the calyx. Calyx with a very long, slender, filiform, delicate, pilose tube about $1\frac{1}{2}$ inch long (looking like a stalk to the flower), suddenly expanded at the top and there deeply cut into two lips, the upper (formed of the 4 upper lobes) with 3 or 4 teeth, erect, the lower narrow acute. Petals inserted in the throat of the calyx, golden yellow, standard broadly orbicular, notched, wings oval-oblong, keel

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* *Arachis*, first used by Ray; altered from *ἀράχιδνα*, the name of some leguminous plant in Theophrastus and employed for this species by Sloane and Plumier.

† *Hypogœa*, from *ὑπό*, under, and *γῆ*, the earth, in allusion to the situation of the pods.

deep, beaked. Stamens 10, inserted with the petals, one often abortive, filaments united throughout nearly their whole length into a tube, anthers alternately large, oval-oblong, and short rounded. Ovary minute, almost sessile at the bottom of the calyx tube, with 2 or 3 ovules, style very long and slender, thickened in the staminal tube, beyond which it projects slightly, stigma very small, capitate. Pod (an inch or more below the surface of the ground) at the extremity of a stiff decurved stalk 2 or 3 inches in length, which has grown beneath the ovary after the fall of the flower, ovoid-oblong, 1—1½ inch long, blunt, cylindrical, somewhat narrowed between the seeds but not articulated or provided with partitions, pericarp indehiscent, thin, brittle, wrinkled all over with a large network of raised ribs, pale brownish yellow. Seeds broadly oblong-ovoid, cylindrical, often flattened at one end and irregular, testa brownish-red, veined, cotyledons plane-convex, large; no endosperm.

Habitat.—This singular little plant is cultivated to a very large extent throughout the tropical regions of the globe, in Africa, Asia, and America, but it is not known in a wild state in any of them. Under these circumstances it is not possible to determine with certainty its native home; it, however, appears probable that it is of American origin, and most likely from Brazil where all the other species are found; it has been suggested by Bentham that it may be a race derived from one of these by cultivation. Its culture is carried on on an immense scale in Western Tropical Africa, and its abundance has led some botanists to consider it there truly native. It flowers in July and August and is grown in several botanic gardens in this country.

The structure of the flowers of this plant was for a long while misunderstood, the calyx-tube being mistaken for a flower-stalk and the flowers described as male, it being considered that there were other apetalous fertile flowers from which the fruits were derived; Poiteau first made the real condition known. The growth of the torus which supports the minute ovary is very remarkable. This commences as soon as the flower withers off; for some time the ovary remains very small and is quite continuous

with the stalk, merely forming its blunt point, in the place of the withered style it becomes covered with a hard cap. The stalk is stiffly reflexed and forces its way downwards beneath the soil, reaching a length of 3 or more inches; when this is effected the maturation of the fruit commences and is completed beneath the ground. If from any cause the ovary does not become thus buried, it does not increase in size or form seeds.

The number of seeds in the pod is by far most frequently two, but three are occasionally met with.

Benth., in Fl. Brasil., Papil., p. 86; Oliver, Fl. Trop. Africa, ii, p. 158; De Candolle, Géogr. Bot., p. 963; Poiteau, in Ann. Sc. Nat., ser. 3, xix, p. 268; Grisebach, Fl. Brit. W. Indies, p. 189; Roxb., Fl. Ind., iii, p. 280.

Official Part and Name.—Oleum Arachis; the oil of the seeds, obtained by expression (I. P.). It is not official in the British Pharmacopœia, or the Pharmacopœia of the United States.

Production and Commerce.—This plant is now cultivated to an enormous extent in Western Tropical Africa, and also on a large scale in India for the sake of its seeds, which are commonly known as *ground nuts* or *earth nuts*. These are principally used for the expression of their oil, of which they yield from about 42 to 50 per cent. This oil is readily obtained by expression either without heat, or by moderately heating the seeds before submitting them to pressure; the oil procured in the first way is of the best quality, but the yield is less. Arachis oil is exported from India; and is also expressed from seeds derived from the West Coast of Africa, to a large and increasing extent at London, Marseilles, Hamburg, Berlin, and other places. At Marseilles more especially, the ground nut now forms a very important article of commerce. This plant is also largely cultivated in the southern parts of the United States.

General Characters and Composition.—This oil is known under various names, as *Arachis oil, ground-nut oil, earth-nut oil,* and also in India, as *Katchung oil*. The cold-pressed oil is nearly colourless, having only a very pale-yellow tinge, a faint agreeable

odour, and a bland taste like that of olive oil; but when obtained from previously heated seeds, it has a darker yellow colour, and a more or less disagreeable taste and odour. The best oil has a specific gravity of about 0·918 at 60°, and is soluble in ether, chloroform, and bisulphide of carbon, but only soluble to a slight extent in alcohol. It becomes turbid at about 37°, and concretes at about 25°. It is a non-drying oil like oil of olives; but it becomes more readily rancid than the latter oil. Falières, however, states that "the manufacture of arachis oil has progressed to such an extent that it is now obtainable as a white, bland, tasteless article, which is, commercially speaking, neutral, and may be kept almost indefinitely without becoming rancid."

Arachis oil is composed of the glycerides of four fatty acids, namely, of *oleic acid* which is its principal constituent, *hypogæic acid*, *palmitic acid*, and *arachic acid*. The experiments of Schroeder show that this oil is not difficult to saponify, as he obtained a perfectly white and odourless soap by boiling the oil with dilute solution of caustic soda for from two to three hours.

Properties and Uses.—Arachis oil forms a good substitute in pharmacy for olive oil, and was on this account made official in the Pharmacopœia of India. It has now almost entirely superseded that of olive oil in our Indian Empire, both for pharmaceutical and other purposes. The experiments of Winter in the United States also show, that it is well adapted for the preparation of cerates and ointments, but that it would not serve as a substitute for olive oil in the preparation of lead plaster. Falières found it to possess great aptitude for the nitric solidification, hence he has recommended its use in the preparation of Unguentum Hydrargyri Nitratis. Arachis oil is said to be largely used for mixing with olive oil.

Arachis oil is also much employed by perfumers in the preparation of pomades, cold cream, &c.; and it is now in extensive demand for soap-making. It may likewise be used for cooking, for burning in lamps, for lubricating watches and other delicate machinery, and for various other purposes.

Other Uses of the Seeds.—Ground nuts or Earth nuts are used

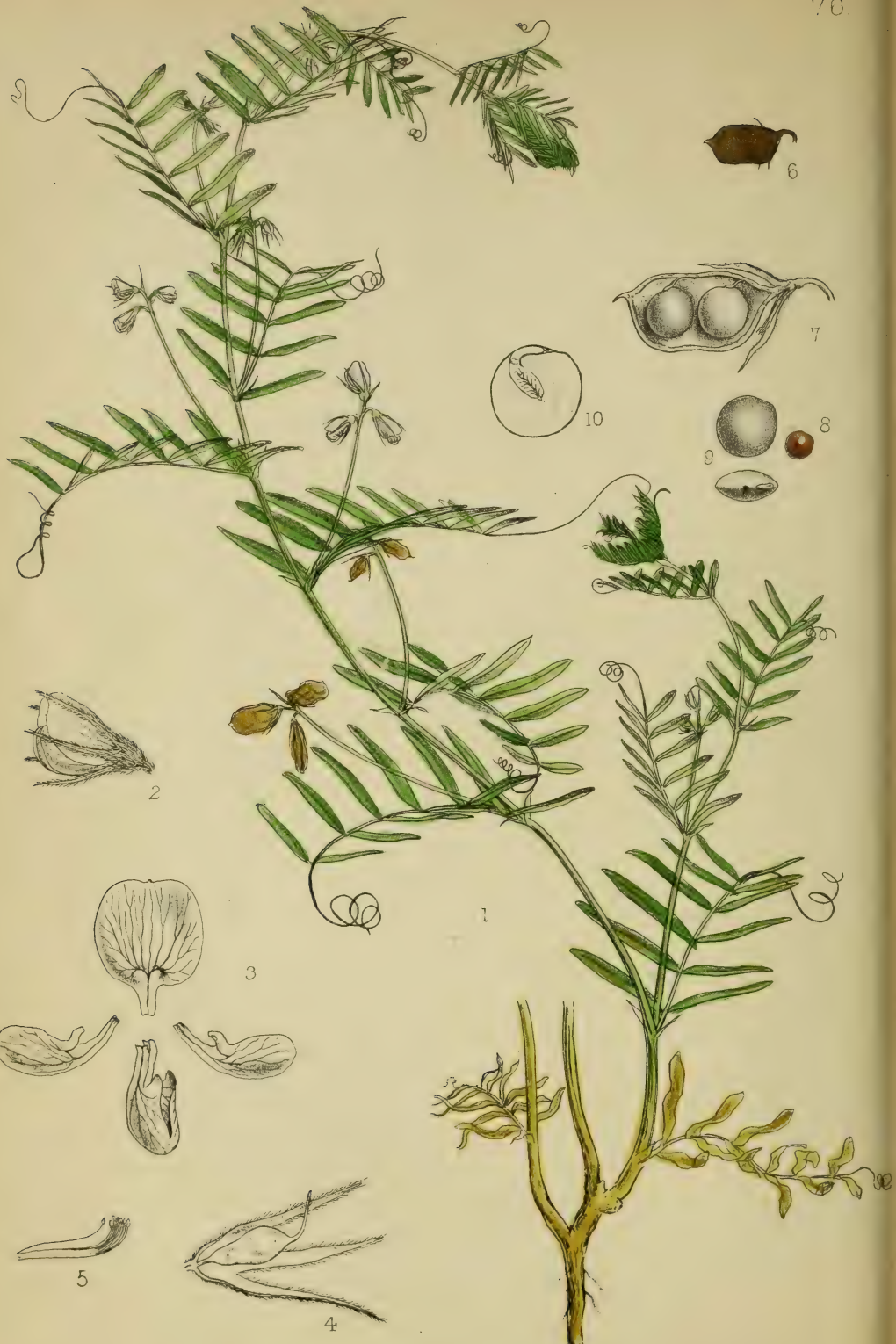
in various parts of the world as food, and are occasionally roasted and served up in the same manner as chestnuts, as an article of dessert in this country. The roasted seeds have likewise been used as a substitute for coffee in the United States and elsewhere. Ground nuts are also employed in America in the preparation of a so-called chocolate. For this purpose they are beaten up in a mortar and the mass compressed into cakes; and it is said to form a most agreeable chocolate, without the admixture of a particle of true cocoa seeds. The Americans also prepare the seeds as a dessert sweetmeat by parching them and beating them up with sugar.

Professor Tuson has recently called attention to ground nut cake which is now used in this country and elsewhere in the sophistication of the more expensive feeding cakes; and he has shown that it is exceedingly rich in flesh formers, that it also contains a moderate amount of oil, has a sweet agreeable taste, is very digestible, and can be purchased at a moderate price; he therefore recommends farmers to give it a trial in the feeding of their stock.

Pharmacopœia of India, pp. 74 and 446; Pharmacographia, p. 163; U. S. Disp., by W. & B., p. 1605; Watts' Dict. Chem., vol. i, p. 353; Winter, in Amer. Journ. Pharm., July, 1860, p. 292; Falières, in Pharm. Journ., ser. 3, vol. iii, p. 1031, from Bull. des Travaux de la Soc. de Pharm. de Bordeaux; Schroeder, in Proc. Amer. Pharm. Assoc., for 1868, from Ann. Ch. Ph.; A. Renard, in Year Book of Pharmacy, for 1872, from Comptes Rendus, vol. lxxiii, p. 1330; Pharm. Journ., vol. i, ser. 3, p. 488, from Nature; Tuson, in Veterinarian, October, 1876, and Pharm. Journ., ser. 3, vol. vii, p. 332.

DESCRIPTION OF PLATE.

Drawn from a plant grown in the Royal Gardens, Kew; the fruit added from a commercial specimen. 1. A branch with flowers. 2. Limb of calyx. 3. Standard. 4. Wing. 5. Keel of corolla. 6. Staminal tube opened. 7. Vertical section of the same. 8. The calyx-tube cut away to show the ovary and lower part of style. 9. A pod. 10. Section of the same. 11. A seed. 12. The same with one cotyledon removed. (2–8 enlarged.)



D.Blair F.L.S. ad sicc. del. et lith. LENS ESCULENTA, *Moench* M&N.Hanhart imp.

N. Ord. LEGUMINOSÆ.

Tribe *Vicieæ*.

Genus Lens,* *Adans.* B. & H., Gen., i, p. 525; Baill., Hist. Pl., ii, p. 238. Species 3 or more, natives of the Mediterranean and Asia Minor.

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76. Lens esculenta, *Moench, Method.*, p. 131 (1794).

Lentil.

Syn.—Ervum Lens, *Linn.* E. himalayense, *A. Br.* Cicer Lens, *Willd.*

Figures.—Sturm, Deutschlands Flora, bd. xvii, heft 4; Berg, Characteristik, t. lxvii, fig. 513.

Description.—An annual. Stem 6—18 inches high, erect, slender, weak, angular or striate, glabrous or hairy, with many long ascending branches from the base. Leaves numerous, alternate, spreading, very shortly stalked, with lanceolate-linear, very acute, spreading stipules at the base, pinnate, the rachis tapering, often recurved, usually terminating in a long simple or slightly branched filiform tendril; leaflets sessile, alternate or sub-opposite, about 6 on each side, narrowly lanceolate-oblong, tapering at the base, obtuse, often mucronate at the apex, entire, finely silky or glabrous. Flowers small, shortly stalked, arranged in little racemose clusters of 2—4 on long peduncles from the axils of the leaves and nearly equalling them in length, prolonged beyond the flowers into a sharp point. Calyx with a short tube and 5 long, linear-acuminate, nearly equal teeth, hairy on the outside, persistent. Corolla papilionaceous, a little shorter than the calyx-teeth, pale blue, standard quadrate-orbicular, with a short broad claw, wings obliquely spathulate, clawed, each with a hooked process on the upper edge which locks with the keel; keel-petals united (except the claws) to form a blunt carina, slightly shorter than the wings. Stamens 10, the vexillary one free, the filaments of the others combined into a sheath. Ovary shortly stalked, with usually 2 ovules; style curved upwards, minutely bearded

* *Lens*, the classical name.

along the inner side, otherwise glabrous, stigma simple. Pod about $\frac{1}{2}$ inch long, broadly oblong or squarish, laterally compressed, apiculate or shortly beaked; 2-valved, smooth, with 1 or 2 seeds. Seeds about $\frac{1}{6}$ inch in diameter, lenticular with the edge sharp or blunt; testa smooth, usually brown or grey; funicle short, expanded at the oblong hilum; cotyledons plane-convex; radicle curved; no endosperm.

Habitat.—The native country of the Lentil is not known. It is one of the mos anciently cultivated plants, was well known to the Egyptians and Persians, and in Europe has been grown since the days of the Roman Empire. At the present day it is very largely cultivated throughout the East, in many parts of Europe, in North Africa (including Abyssinia), and in Western Asia as far as North Western India. It is probably of Asiatic origin, and has been considered to be indigenous to the Himalayas. Though easily grown here, the Lentil is scarcely known in England, even in our botanic gardens. It flowers at the end of June and beginning of July.

The cultivated varieties differ in size and amount of hairiness, colour of the foliage and flowers, and especially in the seeds. These vary much in size and in the amount of compression, as well as in colour, grey, brown, dark red, yellowish, mottled or spotted.

We follow the authors of the 'Genera Plantarum' in conserving the genus *Lens;* it differs but very slightly, however, from the section *Ervum* of *Vicia,* with which many botanists combine it.

Gren. & Godr., Flore France, i, p. 476; Boiss., Fl. Orient., ii, p. 598; Roxb., Fl. Ind., iii, p. 324; Alefeld, Landwithschaftl. Flora, p. 55.

Part Used and Name.—Lentis Semina; the seeds. They are not official in the British Pharmacopœia, the Pharmacopœia of India, or the Pharmacopœia of the United States; nor are they used in medicine; but are only referred to by us on account of their value for food, and from their extensive use on that account in various parts of the world. They are commonly known under the name of Lentils.

General Characters and Varieties.—The more important varieties of lentils are the *French* or *German,* and the *Egyptian* or *Arabian ;* the former are of an ash-grey colour externally, and yellowish within, of a large size comparatively, and of a lenticular form, in fact, the lens is said to have derived its name from its resemblance in form to a lentil seed ; the latter variety of lentil has a dark testa, is of an orange-red colour in its interior, and is much smaller and rounder than the French lentil. The Arabian or Egyptian lentil is that commonly in use ; this is also sometimes known as the *red lentil,* the French and German being also termed the *yellow lentil ;* these names are derived from their different colours internally. Lentils have no marked odour or taste, but resemble beans and peas in these characters.

The foods in common use for invalids, &c., and known under the names of Ervalenta and Revalenta, and generally sold at extravagantly high prices, are essentially composed of lentil meal; although the former sometimes consists, as first shown by Schenk, many years since, of a mixture of equal or nearly equal parts of bean-flour and the flour of Indian corn. Both kinds of food are also frequently mixed with other substances, as barley and wheat flour, sugar, salt, &c. A cheap substitute for the prepared lentil powders as sold under the above names has been given by Hassall ; it is as follows :—Red or Arabian lentil flour, 2 pounds ; barley flour, 1 pound ; salt, 3 ounces To be thoroughly mixed.

Composition.—Like beans, peas, and many other leguminous seeds, lentils contain a large proportion of *legumin* or *vegetable casein,* and are therefore one of the most nutritious of vegetable substances. On an average, the proportion of *legumin* and other nitrogenised matters in lentils is about 25 per cent. They also contain about 35 per cent. of *starch,* and 2 per cent. of *fat ;* besides *gum, sugar, cellulose, pectin,* and *mineral matters.* Hence while they contain a very large amount of nitrogenised matters, they are deficient in starch and fat.

Properties and Uses.—Although lentils have been much vaunted as medicinal agents in constipation and other affections, they have no special value in such cases. But as a food substance lentils

have always been regarded as of considerable value. Thus they are frequently mentioned in the Bible; for instance, in the 25th chapter of Genesis we read that Esau sold his birthright to his brother Jacob for a mess of red pottage made of lentils; and as an article of food they are extensively used at the present day in various parts of the world, more particularly in the East. In this country, however, their consumption is limited, and chiefly confined to the various preparations recommended as food for invalids. The objection to their use as food, as also to other kinds of pulse, is their indigestibility; their principal constituent, legumin, being much more indigestible than other nitrogenous substances. The decorticated lentil seeds are, however, more digestible than those which are whole, as, like many other edible leguminous seeds, the testa of these seeds is very indigestible.

Genesis, xxv, 29–34.

Watts, Dict. Chem., vol. iii, pp. 568 & 570; Lindl. & Moore, Treasury of Botany, part 1, p. 465; Johnston, Chem. of Common Life, vol. i, p. 105; Hassall, Adulterations Detected, p. 330; Pharm. Journ., vol. iv, ser. 1, p. 415, and vol. x, p. 64; Schenk, in Pharm Journ., vol. x, ser. 1, p. 309, from Buchner's Rep., No. 15, p. 321.

DESCRIPTION OF PLATE.

Drawn from a specimen in the British Museum, collected in Egypt by Sir Gardner Wilkinson.

1. Portion of a plant.
2. A flower.
3. Petals separated.
5. Stamens.
4. Section of calyx showing pistil.
6. Pod.
7. The same, with one valve removed.
8, 9. Seeds.
10. The same, with one cotyledon removed.

(2–5, 7, 9, 10 enlarged.)

D.Blair F.L.S. ad nat. del. et lith.

M.& N. Hanhart imp.

ABRUS PRECATORIUS. *Linn.*

N. Ord. LEGUMINOSÆ.

Tribe *Vicieæ?*

Genus **Abrus**,* *Linn.* B. & H., Gen., i, p. 527; Baill., l. c., p. 240. Species 5, dispersed through the hotter regions of the globe.

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77. Abrus precatorius,† *Linn., Syst. Naturæ, ed.* 12, *p.* 472 (1767).

Indian Liquorice. Gunja, Goontch, Gurgonje (India).

Figures.—Rheede, Hort. Malabar., viii, t. 39; Rumph., Herb. Amboin., v, t. 32; Tussac, Fl. Antilles, iv, t. 18.

Description.—A small woody twiner with a long, woody, tortuous branched root reaching $\frac{1}{2}$ inch or more in diameter. Stems slender, cylindrical, branched, with a smooth or wrinkled, brown bark. Leaves alternate, shortly stalked, spreading, 2—6 inches long, abruptly pinnate, stipules small, subulate; leaflets on very short pilose petioles, opposite, in about 8—15 closely placed pairs, $\frac{1}{2}$—$\frac{3}{4}$ inch long, oblong, very blunt at both ends, but often apiculate at the truncate apex, entire, thin, smooth on both sides, articulated and readily falling, with two minute stipellæ at the base of each pair. Flowers small, shortly stalked, in small clusters arranged on large tuberosities along the outer side of a stiff curved rachis, and forming a secund racemose inflorescence terminating a thick, horizontal branch which is naked above, but usually with several closely placed leaves near the base. Calyx small, cup-shaped, truncate at the mouth, with 5 very shallow teeth, membranous, finely pilose. Corolla papilionaceous, rose-coloured, standard ovate, erect, with a short broad claw, wings narrow, falcate-oblong, keel-petals united except the claws, longer than the wings. Stamens 9, the filaments united into a split sheath, the free portions with 5 longer ones alternating with 4

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* *Abrus* is given by Prosper Alpinus (1592) as the name of the plant in Egypt, where the seeds were used for necklaces. Théis derives it from ἁβρος, delicate.

† *Precatorius*, from the use of the seeds as beads.

shorter, anthers uniform. Ovary shortly stalked, very small, downy; style curved glabrous, stigma capitate. Pod about $1\frac{1}{4}$ inch long, broadly oblong, shortly beaked, somewhat compressed, 2-valved, with imperfect septa between the seeds. Seeds 4—6, globular-ovoid, about $\frac{1}{4}$ inch long, testa hard, bright and shining, brilliant scarlet, with a black patch at one end round the hilum, cotyledons plane-convex, no endosperm.

Habitat.—This pretty twiner is common in every part of India, where it is doubtless indigenous. It flowers at the close of the rains. It is also found in South China, the Pacific Islands, tropical Africa, the West Indies, and indeed almost all tropical countries, in most places probably introduced. Plants may also be seen in our botanic gardens, having been grown from seed so far back as the 17th century.

The absence of the upper stamen is remarkable in this genus.

The beautifully coloured and polished seeds are very familiar objects; they, however, vary in colour, being sometimes found black with the eye white, at other times white with a black spot; in the former case the flowers are darker pink and in the latter white.

Roxb., Fl. Ind., iii, p. 258; Fl. Brit. India, ii, p. 175; Fl. Trop. Africa, DC. Prod., ii, p. 381; Lindl., Fl. Med., p. 252; Grisebach, Fl. Brit. W. Indies, p. 190.

Official Part and Name.—Abri Radix; the root (I. P.). It is not official in the British Pharmacopœia, or the Pharmacopœia of the United States.

General Characters and Composition.—Indian Liquorice occurs in pieces of varying length, which are generally more or less twisted and branched; its diameter ranges from half an inch to an inch. It is covered by a very thin, pale-brown or somewhat reddish bark; this surrounds a yellowish woody portion, the fracture of which is short and somewhat fibrous. It is described in the Pharmacopœia of India as inodorous, and with a sweetish and mucilaginous taste, much resembling the ordinary liquorice root; but the authors of Pharmacographia describe it to have "a peculiar disagreeable odour, and a bitterish acrid flavour leaving a faintly

sweet after-taste." Moodeen Sheriff also says that both in a fresh and dried state it does not possess any sweetness at all until it attains a certain size, and that even then its sweet taste is not always well marked. He also thinks that as it is often mixed in the Indian bazaars with ordinary liquorice, the latter may have sometimes been mistaken for it.

No complete analysis of this root has been made; but it appears to contain *sugar*, and the same sweet matter named *glycyrrhizin*, which is contained in the true liquorice root. The leaves of this plant, as first noticed by Berzelius, also contain a sweet principle analogous to that of liquorice.

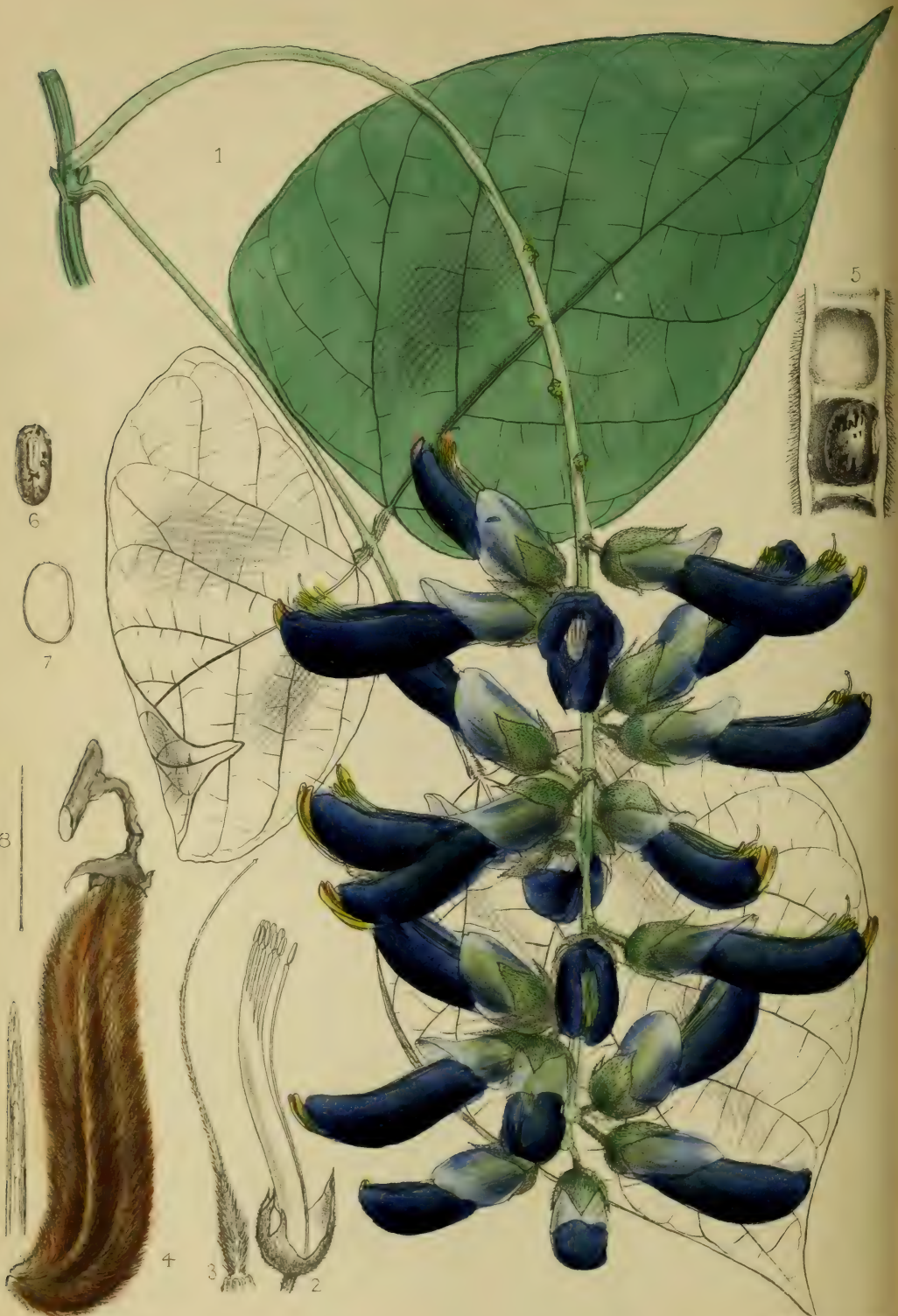
Medical Properties and Uses.—In the Pharmacopœia of India it is stated to possess similar demulcent and emollient properties to those of the true liquorice, and to form an excellent substitute for it; but in the opinion of the authors of Pharmacographia it is a very bad substitute for liquorice.

Other Uses of the Plant.—The seeds, which are of a brilliant scarlet colour, with a black mark on one side where they were attached to the pericarp, are much employed as beads, and for making necklaces, rosaries, &c., hence their common name of *prayer beads*. They are also employed in India as a standard of weight which is much used by Hindoo jewellers and druggists under the name of *Retti* or *Rati*. This weight is estimated as equal to $2\frac{3}{16}$ grains; and it is said that the weight of the celebrated Koh-i-noor diamond was thus ascertained by means of these seeds.

Pharmacographia, p. 164; Shaughnessy, Beng. Disp., p. 297; Drury, Useful Plants of India, p. 3; Waring, in Madras Quart. Med. Journ., 1860, vol. i, p. 61; Fleming's Asiatic Researches, vol. xi; Moodeen Sheriff, Supplement to the Pharmacopœia of India, Madras, 1869, p. 17.

DESCRIPTION OF PLATE.

Drawn from a specimen in the British Museum, collected by Mr. Lamont at Hongkong. 1. A flowering shoot. 2. A flower. 3. The petals separated. 4. The keel. 5. The stamens. 6. The pistil. 7. A cluster of ripe pods. 8. Seeds. 9. Section of the same. (2-6, 8, 9 enlarged.)



MUCUNA PRURIENS DC

N. Ord. LEGUMINOSÆ.

Tribe *Phaseoleæ*.

Genus **Mucuna**,* *Adans.* B. & H., Gen., i, p. 533. Baill., Hist. Pl., ii, p. 248. Species about 22, natives of tropical countries in both hemispheres.

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78. Mucuna pruriens,† *DC. Prod.*, ii, *p.* 405 (1825).

Cowhage.

Syn.—Dolichos pruriens, *Linn.* Stizolobium pruriens, *Pers.* Mucuna prurita, *Hook.* Carpopogon pruriens, *Roxb.*

Figures.—Woodville, t. 153; Steph. & Ch., t. 179; Jacquin, Ic. Americ., t. 122; Wight, Ic., t. 280; Bot. Register, 1858, t. 18; Bot. Miscell., ii, Supp., t. 13; Fl. Brasil. fasc. 24, t. 46, f. 2.

Description.—A large half-woody twiner, with long slender cylindrical branches, at first covered with short reflexed hairs, afterwards nearly smooth. Leaves alternate, pinnately trifoliolate, on hairy petioles 6—12 inches long, stipules small, lanceolate; leaflets on short, thick, hairy stalks, with setaceous stipellæ at their base, 6—8 inches long, the terminal one the smallest, rhomboid-ovate, the lateral ones broadly ovate, very unequal at the base, the lower side being much expanded, all acute or acuminate, entire, membranous, green on both surfaces, nearly smooth above, covered below with adpressed white hairs, especially abundant on the prominent veins. Flowers large, shortly stalked, in clusters of two or three together, in a pendulous, long-stalked, axillary raceme a foot or more in length, rachis and pedicels pilose, bracts ½ an inch long, lanceolate, densely hairy, falling before the flowering period. Calyx cup-shaped, silky externally, deeply cleft in a somewhat two-lipped manner, the two upper segments being perfectly united to form a single triangular one, and the lower three lanceolate, subulate, the middle one the longest. Corolla papilionaceous,

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* *Mucuna* "is the Brazilian name of a species mentioned in 1648 by Marcgraf."

† *Pruriens*, itching, from the effects of the hairs on the skin.

standard broadly oval, acute, about ¾ inch long, with a short claw, pale purplish, wings nearly 1½ inch long, narrow, oblong, blunt, slightly falcate, dull dark purple tinged with pale yellowish-green. Keel-petals narrow, a little longer than the wings, nearly straight, except at the end, where they become hard and cartilaginous, and curve upwards, forming a prominent, stiff, greenish beak. Stamens 10, 9 combined by their filaments, the upper one distinct, fore part of the filaments somewhat dilated, anthers small, soon falling, oblong. Ovary surrounded at the base by a small crenulate disk, shortly stalked, hairy, tapering into the long slender style, stigma small, terminal. Legume nearly sessile, about 3 inches long by more than ½ inch broad, falcately curved at each end, somewhat compressed, slightly contracted between the seeds, dark brown, very densely covered with a thick felt of stiff, short, sharp, pale reddish hairs, which point backwards and are readily detached; when young the pods have a strongly marked rib down each valve, which is concealed by the hairs. Seeds 4 or 5, separated by cellular partitions, about ¼ of an inch long, ovoid, somewhat compressed, smooth, brownish, mottled with black, hilum large, oblong.

Habitat.—This is a common twiner over bushes and hedges in peninsular India, where it is extensively distributed, and is probably native. The plant occurs in a cultivated or semiwild state throughout the tropical regions of both hemispheres.

The meaningless word "cowitch" is a corruption of the Hindustani name for the plant, variously spelt cowhage, couhage, kiwach.

Roxburgh, Fl. Indica, iii, p. 283; Hook., Bot. Miscell., ii, p. 348; Fl. Brasil., fasc. 24, p. 169, Fl. Trop. Africa, ii, p. 187; DC., Prod., ii, p. 404; Lindl., Fl. Med., p. 253-4.

Official Part and Names.—Mucuna, *Cowhage;* the hairs of the pod (I. P.). Mucuna; the hairs of the pods (U. S. P. *Secondary*). It is not official in the British Pharmacopœia, but it was formerly official in the London, Edinburgh, and Dublin Pharmacopœias.

General Characters and Composition.—The pods or legumes are imported from the West Indies with the hairs attached. The

legumes, which are somewhat compressed, vary in length from about 2 to 5 inches, averaging about 4 inches, and are commonly about ½ an inch in breadth; they are slightly curved at each end, and contain from four to six seeds. They have a dark rich-brown colour, and are densely covered with stiff brownish-red hairs, each of which is about $\frac{1}{10}$ of an inch in length. These hairs, which are readily separated from the legumes, constitute the official *Cowhage;* it is also termed *Cow-itch.* When examined by a magnifying lens, each hair is seen to consist of an acutely pointed conical cell, which is slightly serrated towards its apex. When handled or incautiously touched, the hairs penetrate the skin, and produce an intolerable itching. As a general rule they are filled with air, but sometimes they contain a granular matter, of which *tannic acid* is one of the constituents.

Medical Properties and Uses.—Mucuna is a mechanical anthelmintic; that is, the hairs when given medicinally, pierce the bodies of intestinal worms, and by thus causing them to writhe, they become detached from the walls of the intestines. That their action is thus mechanical is proved by the fact, that neither the administration of the tincture, decoction, or any corresponding preparation of mucuna, is in any degree anthelmintic. Cowhage has little or no effect upon the tape-worm, but has been more especially employed with success for the expulsion of the large round worm (*Ascaris lumbricoides*), and to some extent also, for that of the small thread-worm (*Oxyuris vermicularis*). The best mode of administering cowhage is in the form of an electuary with treacle, syrup, or honey. The legumes should be dipped in the vehicle, and then scraped until the mass has the consistence of an electuary, or of thick honey; and of this mixture a table-spoonful may be given to an adult, and a teaspoonful to a child, for three or four successive mornings. This should be followed by a brisk purgative, which will in general bring away the worms. Mucuna is, however, but little used at the present day, although its efficiency is undoubted. It is, moreover, generally a safe remedy, but severe enteritis has sometimes followed its administration. Mucuna has also been used externally in the form of an ointment,

and in other ways, as a local stimulant in paralysis, and other affections.

A decoction of the root or of the legumes is said to be diuretic, and was formerly employed in dropsy; and according to Ainslie, an infusion of the root is used by the natives in some parts of India as a remedy in cholera. The seeds are also employed medicinally in India.

The legumes when young and tender are also cooked and eaten in India.

Per. Mat. Med., vol. ii, pt. 2, p. 322; Pharmacographia, p. 165; U. S. Disp., by W. & B., p. 567; Browne's Jamaica, p. 291; Chamberlaine's Prac. Treat. on Stizolobium or Cowhage, 9th edit., pp. 57 and 65.

DESCRIPTION OF PLATE.

Drawn from Indian specimens in the herbarium of the British Museum.

1. A leaf and raceme of flowers.
2. Calyx and andrœcium.
3. Pistil.
4. A pod.
5. Section of part of pod showing the seed.
6. Seed.
7. Section of the same.
8. A single hair from the pod, enlarged.
9. The point of the same, more magnified.

5
7

D Blair F.L.S. ad nicc. del et lith.

BUTEA FRONDOSA, *Roxb.*

M & N Hanhart imp

N. Ord. LEGUMINOSÆ.

Tribe *Phaseoleæ*.

Genus **Butea**, *Roxb.** B. & H., Gen., i, p. 533; Baill., Hist. Pl., ii, p. 249. There are 3 species, natives of tropical Asia.

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79. Butea frondosa, "*Koenig*," *Roxb., in Asiatic Researches* iii, *p.* 469 (1792).

Palas. Plas. Dhak.

Syn.—Erythrina monosperma, *Lam.*

Figures.—Roxburgh, Plants of Coromandel, t. 21, copied in Hayne, x, t. 6, and Nees, Supp., t. 10; Beddome, Fl. Sylvatica, t. 176; Rheede, Hort. Malabar., vi, tt. 16, 17.

Description.—A moderate sized tree, with a generally crooked trunk and very irregular branches and rough, thick, ash-coloured bark, the young shoots strongly pubescent. Leaves alternate, spreading, large, pinnately trifoliolate, long-stalked; petiole slender, cylindrical, thickened at the base, downy when young, stipules small, deciduous, linear-lanceolate, leaflets 3, an opposite pair and a terminal one, unequal, the terminal one usually considerably the largest, on short cylindrical pubescent petiolules with minute stipellæ at the base, 3—8 inches long, orbicular-obovate, very obtuse, entire, stiff, when mature glabrous above, much reticulately-veined and closely tomentose beneath, when young white and silky on both surfaces. Flowers very large and numerous, on twisted or pendulous stalks about ¾ inch long, arranged in threes on the sides of long rigid peduncles a foot long which come off from tuberosities on the wood, and forming very large racemose panicles, bracts small lanceolate at the base of the pedicels and two very small ones immediately beneath the flowers; rachis and pedicels very densely clothed with short

* *Butea*, in honour of John Stuart, 4th Earl and 1st Marquis of Bute, a great patron of botany, and the author of a magnificent but useless work on British plants, in 9 folio volumes, of which only 12 copies were printed. He died in 1814.

purplish-green tomentum. Calyx shallowly campanulate thick, covered with a similar close tomentum, gibbous above, obscurely 2-lipped, the upper lip faintly emarginate, the lower cut into 3 broad, shallow, equal teeth. Petals papilionaceous, all nearly equal, about 1½—2 inches long, bright red shaded with orange, veined, covered externally with a fine adpressed shining silvery pubescence so that the buds are quite white; standard ovate-attenuate, reflexed, the margin involute, wings falcate, acute, widely spreading, keel-petals united throughout except the incurved claws to form a deep boat-shaped acute carina. Stamens 10, the upper one free with the filament hairy, the remainder united into a sheath, all included in the keel, anthers reniform. Ovary shortly stalked, linear, very densely hairy, containing 2 ovules; style very long, much incurved, projecting beyond the anthers, smooth, deciduous; stigma simple. Pods 4—6 inches long, pendulous, shortly stalked, oblong, blunt, very much laterally compressed, flat, thickened at the sutures, leathery, thinly downy especially towards the end and on the margins, the lower ¾ indehiscent and without seeds, the terminal ¼ containing a single seed and splitting along the edge. Seed flat, very much compressed, about 1¼ inch long, very broadly oval, smooth, reddish-brown, with a small hilum.

Habitat.—A common tree throughout India, and very conspicuous in March and April, when its abundant showy flowers, which precede the new foliage, form a magnificent sight. The abundance of Palas trees gave the name of Plassey to the site of Clive's decisive battle. It is also met with in Java, Burmah, and Ceylon. It ascends to 3000 or 4000 feet in the N. W. Himalaya, and grows in the open country, not in forests. It is often cut down so as to form a shrub.

Roxburgh ascribes the name *Butea frondosa* to Koenig, but we have not been able to find that the latter had ever published it.

Roxburgh, Plants of Coromandel, i, p. 21; Fl. Brit. India, ii, p. 194; Brandis, Forest Flora, p. 142; Lindl., Fl. Medica, p. 254.

Official Part and Names.—Buteæ Gummi, Kino Bengalensis; the inspissated juice obtained from the stem by incision (I. P.). It is not official in the British Pharmacopœia, or the Pharmacopœia of the United States. But it was recognised as an official kino in the Dublin Pharmacopœia of 1807. Its botanical source is not exclusively *Butea frondosa*, Roxb., but it is also derived from the allied species *B. superba*, Roxb., and *B. parviflora*, Roxb. It is known commonly under the names of *Butea Gum, Butea Kino, Bengal Kino, Palas or Pulas Kino*, and *Gum of the Palas or Dhak tree.*

Collection.—It is either obtained by incision; or according to Roxburgh, Bengal kino issues from natural fissures and wounds made in the bark of the tree during the hot season, as a most beautiful red juice, which soon hardens into a ruby coloured, brittle, astringent gum.

General Characters and Composition.—Bengal kino occurs in the form of irregular, angular, flattish fragments, which are rarely half an inch in breadth; or in stalactitic pieces; or in small, somewhat oval drops or tears, which are commonly about the size of a grain of barley. Externally the fragments and drops are smooth and shining, except that the flattish pieces show, commonly on one side, an impression of the veins of the leaves on which they have been dried. This kino is more or less mixed with adherent pieces of greyish bark. In mass, the separate portions of Bengal kino have a blackish, somewhat opaque, appearance, but when small thin pieces or tears are examined by transmitted light, they are perfectly transparent, and of a beautiful ruby-red colour. This kino is very brittle, and its powder has a reddish colour, which is somewhat brighter in tint than that of our official kino from *Pterocarpus Marsupium.* It has no odour; but a pure astringent taste. It does not stick to the teeth when chewed like ordinary kino, but it tinges the saliva red. It is soluble, although not freely so, in water and alcohol; but different specimens vary a good deal in regard to their degrees of solubility.

Bengal kino has been examined by E. Solly, who found it to consist essentially of *tannic acid, extractive, gum,* and

a little *gallic acid.* The authors of Pharmacographia infer from their experiments that the tannic acid found in Bengal kino is the kind called *kino-tannic.* They also removed from this kino by ether, a small quantity of *pyrocatechin,* which substance is also obtainable from it by dry distillation. It is probably very closely allied to our official kino in its chemical composition.

Medical Properties and Uses.—Its properties are the same as our official kino, for which it forms an efficient substitute; it is used in India in similar cases. It is also applicable as a tanning and dyeing agent; but it is objected to by the English tanner on account of the colour it communicates to leather.

Other Products of the Butea frondosa.—The *seeds* have a considerable reputation amongst the Mahomedan doctors in India, as a vermifuge. For this purpose Dr. Oswald recommends that they should be first soaked in water; and then after the careful removal of the integuments, the kernels are to be dried and powdered. Of this powder, the dose is twenty grains three times a day for three successive days, to be followed on the fourth day by a dose of castor oil. Their use, however, is sometimes attended with ill effects; hence further observations on their action are desirable. From these seeds, the oil known in India, as *moodooga oil,* is also obtained; it is regarded as an anthelmintic.

The *dried flowers* of this species and those of *Butea superba,* are called *tisso, teesoo, keesoo,* or *kesaree* flowers, in India, where they are used in the production of beautiful yellow and orange-red dyes; but the tints are not permanent.

A coarse fibrous material is also obtained from the inner bark, which is termed *Pulas cordage;* it is principally used instead of oakum, for caulking the seams of boats.

The substance known as stick-lac, which is employed in the manufacture of sealing wax, and in dyeing, &c., is also derived from this tree. It is produced on the young twigs by the punctures of a species of *Coccus.*

Christison, Disp., p. 577; Per. Mat. Med., vol. ii, pt. 2, p. 329; U. S. Disp., by W. & B., p. 512; Pharmacopœia of India, pp. 73 & 79; Pharmacographia, p. 173; Treasury of Botany, vol. i, p. 183; O'Shaugnessy, Bengal Disp., p. 296; Roxburgh, Fl. Indica, vol. iii, p. 245; Royle, in Pharm. Journ., vol. v, ser. 1, pp. 495 & 500.

DESCRIPTION OF PLATE.

Drawn from specimens in the British Museum collected in India by Kœnig, and in Ceylon by Thwaites.

1. Part of a raceme of flowers.
2. The keel of the flower.
3. Calyx and stamens.
4. Pistil.
5. Cluster of pods.
6. A seed.
7. A leaf.

D.Blair del. et lith. ad acuter.

M & N Hanhart imp.

PHYSOSTIGMA VENENOSUM *Balf*

N. Ord. LEGUMINOSÆ.

Tribe *Phaseoleæ*.

Genus Physostigma,* *Balfour*. B. & H., Gen., i, p. 538; Baill., l. c., p. 233. One species only known.

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80. Physostigma venenosum, *Balf. in Trans. Roy. Soc. Edinb.*, xxii, *p.* 310 (1861).

Calabar Bean.

Figures.—Trans. Royal Soc. Edinb., xxii, tt. 16, 17; Baill., l. c., figs 153–155.

Description.—A large perennial climber; the stem, which is woody and 2 inches in diameter below, reaching sometimes 50 feet in length, cylindrical, smooth, slender. Leaves alternate, large, pinnately trifoliolate; petiole stiff, thickened at the base, with small triangular stipules; leaflets stalked, with short thickened petiolules and small stipellæ, 3—6 inches long, ovate-attenuate, the terminal one broader, the lateral ones unequal at the base, veiny, smooth. Flowers rather large, in long, lax, pendulous zigzag racemes, with a thick rachis set with large solid tubercles or knots, from each of which spring two or three articulated, short, slender, smooth pedicels. Calyx cup-shaped gibbous above, smooth, somewhat fleshy, 5-lobed, the two upper lobes obsolete, truncate. Corolla papilionaceous; standard ovate-orbicular when expanded, but folded together and curved back into almost a ring, auriculate at the base, beautifully and finely veined; wings free, almost hidden by the standard, obovate-triangular, curved upwards, eared near the base, with a longish claw; keel half concealed, greatly prolonged and stiffly twisted into a somewhat spiral beak. Stamens 10, the upper one free, the other 9 combined for about half their length into a sheath round the pistil; anthers small, similar. Ovary stalked, the stalk surrounded by a prominent 10-lobed disk, style about $1\frac{1}{2}$ inch long filiform, curved with

* From φύσα, a bladder, and stigma; on the supposition that the stigmatic appendage was hollow and inflated.

the keel and becoming thickened and stiff in its twisted beak, where it forms a ring densely bearded on the inner side of its distal half with crisp hairs, and provided at the extremity with a triangular, solid, fleshy, reflexed, beaked appendage. Pod shortly stalked, 4 to 7 inches long, compressed, pointed at the end, 2-valved, valves rather thin, horny, pale brown, with a network of transverse veins, thickly lined within with a white loose woolly tissue. Seeds 2 or 3 in the pod, oblong tending to reniform in outline, $1\frac{1}{4}$ inch long by $\frac{5}{8}$ inch wide, flattened on the back, rounded on the front, sides, and ends, hilum very long, linear, extending from the micropyle at one end entirely along the rounded side of the seed to the opposite extremity, with a raised border, and marked down the centre by a thread-like line (raphe); testa nearly smooth, dark chocolate-brown, paler on the borders of the hilum which is black, lined with a yellowish skin; cotyledons when dry semilunar on section, leaving a hollow space between them, with a shallow groove running down the side next the hilum; radicle short, terete.

Habitat.—A native of an apparently restricted portion of west tropical Africa, near the mouth of the Niger and Old Calabar, in the Gulf of Guinea; it seems to be somewhat rare even there, and is said to be destroyed everywhere by order of the government except where it is preserved for the use of justice, as an ordeal. The plant has been introduced, however, into Brazil and India. The seeds readily germinate; but in this country we believe that the plants have not as yet produced flowers. In appearance and structure *Physostigma* is very close to *Phaseolus*, in which genus is included the Scarlet Runner and Haricot Bean; indeed the remarkably large hilum of the seed and the stigmatic appendage are the only distinguishing characters. The late D. Hanbury first pointed out that this appendage is not hollow, but solid. We are indebted to Prof. Balfour for the loan of the original specimens from which he described the plant, as well as for a carefully coloured plate, of which the artist has availed himself.

Balfour, l. c., p. 310; D. Hanbury, in Journ. Botany, 1863, p. 239; Flora Trop. Africa, ii, p. 191.

Official Part and Names.—PHYSOSTIGMATIS FABA; the seed (B. P.). The seeds (*Physostigmatis Semina*) (I. P.). PHYSOSTIGMA; the seed (U. S. P.).

General Characters and Composition.—These seeds, which are commonly known as Calabar Beans, are imported from Western Africa. They are about the size of a very large horse bean, averaging from 1 to 1¼ inch long, ¾ of an inch broad, and 65 grains in weight. In shape they are somewhat reniform, being straight or slightly concave on one side, and convex on the other. The convex side is marked by a long, broad, black furrow (*hilum*), with raised edges, which terminates in a small depression or aperture (*micropyle*) near one end. The furrow is also traversed from end to end by a central raised line, which corresponds to the raphe. The seeds are covered by a hard, brittle, somewhat rough, shining integument or testa, which is commonly of a deep chocolate-brown colour, except on the raised edges of the furrow, where the tint is lighter. In some cases, however, the colour of the seeds is brownish-red or ash-grey. The nucleus or kernel principally consists of two hard, white, brittle, cotyledons, closely adherent to the testa, and separated from each other by a largish cavity. The seeds have no marked taste, simply that of an ordinary bean, and no odour. They yield their virtues entirely to alcohol, and imperfectly to water. The characters of Calabar beans are so marked, that they may be readily distinguished from all other seeds which may be mixed with them. We have frequently so noticed the seeds of a species of *Mucuna;* and others, have also detected those of the Oil Palm (*Elæis guineensis*).

Calabar beans contain about 48 per cent. of starch, 23 per cent. of albuminous matter, a little fatty oil, mucilage, sugar, and other unimportant ingredients, and a peculiar alkaloid on which their activity depends. This was discovered in 1863 by Jobst and Hesse, and named *physostigmin;* it is principally contained in the kernel, but as shown by Fraser, the shells are not devoid of active principle. The *physostigmia* or *physostigmin* as thus found by Jobst and Hesse is an amorphous

mass, of a brown colour, readily soluble in alcohol, ether, and acids, but less so in water. Its watery solution has an alkaline reaction; and on exposure to the air soon becomes red or sometimes blue, from a partial decomposition of the alkaloid. As subsequently obtained by Hesse, it was perfectly colourless and tasteless, and on exposure to a temperature of 212° it reddened, owing to decomposition commencing. In 1865, Vée and Leven, by operating in essentially the same manner as Hesse, obtained an alkaloid in the form of colourless, rhomboidal, tabular crystals, having a bitter taste, but agreeing in most other respects with the physostigmia, as just described. These chemists called this substance *eserin*. Tison and other chemists regard *eserin* or *eseria* as pure *physostigmia;* but Flückiger and Hanbury remark that "at present we feel hardly warranted in admitting the identity of the two substances." The activity of eseria or physostigmia? is indicated by the fact that if a single drop of a solution containing only 1 part in 1000, be placed within the eyelids, it causes great and lasting contraction of the pupil. A peculiarity of the alkaloid, according to Vée is, that if to its solution in water a little potash, lime, or soda be added, a red coloration is produced, which rapidly becomes more intense. The colour is not, however, permanent, but gradually passes into yellow, green, and blue. The same property is also said to be possessed by the alcoholic extract of Calabar bean.

Medical Properties and Uses.—From the experiments of Dr Fraser and others, it has been proved that Calabar bean is a powerful sedative of the spinal cord, producing in over-doses paralysis of the lower extremities and death by asphyxia, or in still larger doses, death by paralysis of the heart. When applied locally to the eye, it rapidly induces contraction of the pupil. The principal use of the Calabar bean is as a local application to the eye, to cause contraction of the pupil, in certain diseases and injuries of that organ. It has also been given internally in small doses, and with some benefit, in tetanus, chorea, epilepsy, and other nervous affections; also in the treatment of strychnia poisoning, general paralysis of the insane, and other affections.

The physiological antagonism of atropia and physostigma would also direct attention to the use of the latter in poisoning by the former. Atropia has also been found useful in poisoning by the Calabar bean.

Per. Mat. Med., by B. & R., p. 842; Pharmacographia, p. 167; U. S. Disp., by W. & B., p. 669; Journ. de Pharm., 1864, p. 277; Chem. News, 22 March, 1867, p. 149; Mayer, Amer. Journ. Pharm., 1865, p. 173; Comptes Rendus, 1865, p. 1194; Edin. Journ. Med. Science, vol. xx, p. 193; Pharm. Jl., vol. xiv, p. 470; Fraser, in Edin. Med. Journ., July, 1863, p. 36; Robertson, Edin. Med. Journ., March, 1863, p. 815; Bouchat, Bull. Gener. de Therap., 1875.

DESCRIPTION OF PLATE.

The flowering branch from a specimen in spirit collected at Old Calabar, in the collection of the late D. Hanbury; the fruit from a specimen in the British Museum, collected at Old Calabar by the Rev. Z. Baillie.

1. A flowering branch.
2. Pistil, half of the calyx removed.
3. Terminal part of style and appendage.
4. Transverse section through the appendage.
5. A pod.
6, 7. Seeds.
8. Transverse section of a dry seed.
9. Base of one cotyledon, showing radicle and plumule.

(3, 4 and 9 enlarged.)

D. Blair ad nat. del. et lith.

M&N Hanhart imp.

PTEROCARPUS MARSUPIUM, *Roxb*

N. Ord. LEGUMINOSÆ.

Tribe *Dalbergieæ*.

Genus Pterocarpus,* *Linn.* B. & H., Gen., i, p. 547; Baill., l. c., p. 319. Species 15, inhabiting tropical Asia, Africa, and America.

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81. Pterocarpus Marsupium,† *Roxburgh, Plants of Coromandel, ii, p.* 9 (1798).

Vengay (Tamil). *Buja* (Bengal). *Bastard Teak.*

Figures.—Roxburgh, l. c., t. 116; Beddome, Fl. Sylvatica, t. 21.

Description.—A large deciduous tree with an erect trunk 6—8 feet in girth and numerous spreading horizontal branches, bark brownish-grey, coming off in flakes, the inner bark fibrous, red. Leaves abundant, alternate, without stipules (?), unequally pinnate, petioles round, slender, slightly thickened at the base; leaflets 5 to 7, alternate, on short thickened stalks, oval or oblong-ovate, 2—4 inches long, blunt or subacute, emarginate, entire, coriaceous, smooth, dark green and shining when full grown, with numerous lateral veins connected by raised reticulations. Flowers rather small, in lax terminal or axillary paniculate racemes, shortly stalked, the peduncles and pedicels more or less silky with adpressed hairs, bracts minute deciduous, buds curved. Calyx tubular-campanulate with 5 short nearly equal blunt teeth, very shortly silky. Corolla papilionaceous, petals nearly equal with long claws, wavy at the margins, pale yellow; standard narrow, recurved, wings free, turned down, keel-petals connected in front, curved upwards. Stamens 10, filaments monadelphous, forming a tube for about half their length, sometimes split into 2 bundles of 5 stamens, anthers small. Pistil small, stipitate, hairy, style pointed. Pod indehiscent, stalked, greatly compressed, orbicular, 1—1½ inch wide, falcate the style having become lateral, hard, leathery, finely silky, with a broad, crisped, veined, parchment-

* Name from πτερόν, a wing, and καρπός, fruit, from the winged legumes.

† *Marsupium*, a pouch, from the shape of the fruit.

like wing. Seed solitary, kidney-shaped, or two separated by a strong partition, without endosperm.

Habitat.—This fine timber tree grows in the forests of Southern and Central India, where it was formerly common, but has become nearly extirpated in many places, and large trees are now rare. It is also found in Ceylon. The flowers appear in May and June.

Roxb., Fl. Indica, iii, p. 234; Brandis, Forest Fl. Ind., p. 152; Royle, in Pharm. Journ., v (1846), p. 495; Lindl., Fl. Med., p. 256.

Official Part and Name.—KINO; the inspissated juice obtained from incisions made in the trunk (B. P.). The inspissated juice obtained from incisions in the trunk (*Kino*) (I. P.). KINO; the inspissated juice of Pterocarpus Marsupium, and of other plants (U. S. P.).

Varieties of Kino.—The term kino is applied to the juice of the tree now under consideration, as well as to that of other plants, inspissated without artificial heat. Several varieties are known to pharmacologists; but those commonly distinguished in Europe, the United States, and India, are as follows:—1. *Malabar* or *East Indian Kino,* from Pterocarpus Marsupium, *D. C.;* 2. *African* or *Gambia Kino,* from Pterocarpus erinaceus, *Poiret;* 3. *Butea, Bengal, Palas* or *Pulas Kino,* or *Butea Gum,* from Butea frondosa, *Roxb.,* and allied species of Butea; 4. *Botany Bay, Australian,* or *Eucalyptus Kino,* from numerous species of Eucalyptus; 5. *West Indian* or *Jamaica Kino,* from Coccoloba uvifera, *L.;* and 6. *South American* or *Caracas Kino,* which is supposed by some authors to be the same kind as that described by Guibourt, under the name of *Columbian Kino.* The botanical source of the latter variety is not known with certainty; though believed by Wood and Bache to be derived from the same plant as that yielding West Indian Kino. Some of these varieties of kino have the appearance of extracts, rather than that of juices inspissated without artificial heat, to which the term kino is only strictly applicable. All of them have similar medical properties, and

analogous chemical characters, and some have a considerable similarity of appearance. In the British Pharmacopœia Malabar or East Indian Kino is alone official; in the Pharmacopœia of India, this kind as well as Bengal or Butea Kino are recognised; while in the Pharmacopœia of the United States, East Indian Kino, and also that of other plants are official. Our future remarks in this article will refer simply to Malabar or East Indian Kino, but the more important of the other varieties are described under the plants yielding them.

Malabar or East Indian Kino.—*Extraction and Commerce.*—This kind of kino derives its name from being obtained in the forests of Malabar, where permission is granted by government for its collection, on the payment of a small fee. In order to obtain it, the trees are incised as follows:—A perpendicular incision, with lateral ones leading into it, is made in the trunk, when the juice, which has the appearance of red currant jelly, exudes, and is collected by placing a suitable vessel at the lower end of the incision. This juice is then dried by exposure to the sun and air, and subsequently packed in wooden boxes for exportation. The amount of kino exported from Malabar is said not to exceed two tons annually.

General Characters and Composition.—Malabar kino is found in small, angular, very brittle, glistening fragments, of a reddish-black colour. When entire the fragments are opaque; but in thin laminæ and at the edges they are transparent, and of a ruby-red colour. They are without odour; but with a very astringent taste; and when chewed they stick to the teeth, and tinge the saliva blood-red. Kino is partially dissolved by cold water, more readily by boiling water, and almost entirely soluble in spirit of wine of specific gravity 0·838. All these solutions have a red colour, the intensity of which will depend upon the quantity of kino taken up; the solution in boiling water becomes turbid on cooling, and deposits a red sediment. The spirituous solution has an acid reaction on litmus paper; and when long kept it frequently assumes a gelatinous condition. Kino is altogether insoluble in ether.

In a chemical point of view kino closely resembles Pegu Catechu derived from Acacia Catechu, *Willd.*, and Pale Catechu from Uncaria Gambier, *Roxb.*, both of which are described under the plants yielding them. Its essential constituents are *catechin* or probably *pyrocatechin, kino-tannic acid,* and *kino-red.*

Medical Properties and Use.—In its action kino is closely allied to catechu, but on account of its comparative insolubility it is less astringent, and is, therefore, commonly regarded as less effective. It may be used, however, in all cases where tannin is indicated, that is, internally in diarrhœa and pyrosis; in the form of a gargle in relaxed throat; as an injection in leucorrhœa, &c.; and as a topical application to indolent and flabby ulcers.

Kino is also used in the manufacture of wines; and would be valuable as a tanning and dyeing agent if it could be obtained at a moderate price.

Per. Mat. Med., vol. ii, pt. 2, p. 325; Pharmacographia, p. 171; U. S. Disp., by W. & B., p. 509; Royle, Pharm. Journ., vol. v, 1st ser., p. 495; Daniell, Pharm. Journ., 1st ser., vol. xiv, p. 55; Cleghorn, Forests and Gardens of South India, p. 13 (1861).

DESCRIPTION OF PLATE.

Drawn from specimens in the British Museum; the fruit collected in India by Roxburgh, the flowering branch by Thwaites in Ceylon (no. 1495).

1. A branch with flowers.
2. A flower.
3. The petals separated.
4. The tube of stamens.
5. Fruit.

(2–4 enlarged.)

M&N. Hanhart imp

PTEROCARPUS SANTALINUS, *Linn fil.*

N. Ord. LEGUMINOSÆ.
Tribe *Dalbergieæ*.
Genus Pterocarpus, *Linn.*

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82. Pterocarpus santalinus,* *Linn. f., Suppl. Pl., p.* 318 (1781).

Chandam. Chundana. Red Sanders Wood. Ruby Wood.

Figures.—Woodville, t. 156 (drawn from Koenig's specimen in Herb. Banks); Beddome, Fl. Sylvatica, t. 22.

Description.—A small tree about 20 to 25 feet high, the trunks of very old and hollow ones reaching as much as 4½ feet in circumference. Leaves alternate, without stipules, on round downy petioles, always trifoliolate; leaflets articulated, the lower pair alternate or sub-opposite, all on short stalks, broadly oval or sub-orbicular, rounded at both ends and deeply emarginate, 2—6 inches long, coriaceous, slightly silky below, veins numerous, not prominent. Flowers much as in *P. Marsupium*, but a little smaller, and the petals less crisped, yellow; stamens diadelphous in 2 bundles of 5 each. Pod very like that of the last, but with a less crisped wing and a longer stalk, downy. Seeds 2 or solitary.

Habitat.—The Red Sanders Wood is a rare tree found in abundance only in a few parts of the Madras Presidency, on low hills, and nowhere else in India. It is readily distinguished from *P. Marsupium* by its constantly trifoliolate and broader leaflets. Plantations have been formed for its cultivation in S. India.

Roxb., Fl. Ind., iii, p. 234; Lindl., Fl. Med., p. 257.

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* *Santalinus*, referring to its name of red *Sandal* wood, which all its Indian titles signify, though it bears no relationship to *Santalum*.

Official Part and Names. — PTEROCARPI LIGNUM; the wood (B. P.). The wood (*Lignum Santalinum rubrum*) (I. P.). SANTALUM; the wood (U. S. P.).

General Characters and Composition.—Red Sandal Wood, Red Sanders or Saunders Wood, is generally imported from Ceylon; and as found in English commerce, it is principally obtained from the lower parts of the stem, and from the thick roots. It occurs in roundish, somewhat angular, or irregular logs or billets, which are without bark and sapwood, from about three to five feet in length, and in some cases as thick as a man's thigh, although usually much smaller. These billets are heavy, dense, externally dark reddish- or blackish-brown, and internally, if cut transversely, of a deep blood-red, variegated with zones of a lighter red colour. The wood is usually found in the pharmacies in the form of raspings, chips, or coarse powder, of a deep reddish-brown colour. Red Sandal Wood has a very slightly astringent taste, and is almost odourless, although when rubbed it has a faint peculiar smell.

The colouring principle of red sandal wood is almost insoluble in water, either hot or cold, and also in fixed oils, such as almond and olive; but it is readily soluble in ether, alcohol, concentrated acetic acid, and alkaline solutions, and forms deep coloured solutions. It is also insoluble in oil of turpentine; but partially soluble in some of the essential oils, as those of lavender, rosemary, cloves, and oil of bitter almonds. This colouring principle, which is termed *santalic acid* or *santalin*, is a resinous ruby-coloured substance, without taste or odour, fusing at 202°, and forming uncrystallisable salts with alkalies. Weidel also obtained from the wood a minute quantity of colourless, tasteless crystals, which he called *santal*. The wood also contains a small quantity of some kind of tannin, probably *kino-tannic acid*.

Medical Properties and Uses.—Although much used in India as an astringent, it can scarcely be said to have any virtue as a medicine, but to be simply useful as a colouring agent.

The chief use of red sanders wood is as a dye stuff. Thus in India it is employed mixed with sapan wood, for dyeing silk,

cotton, and wool, to which it imparts reds of various shades, according to the kind of mordant used.

Pharmacographia, p. 175; U. S. Disp., by W. & B., p. 772; Gmelin's Chemistry, vol. xvi, p. 259; Ure's Dict. Arts, vol. iii, p. 631; Amer. Journ. Pharm., Jan., 1860, p. 6.

DESCRIPTION OF PLATE.

Drawn from Indian specimens in the British Museum, collected by Koenig and by Hamilton; the section of the fruit added from Beddome's figure.

1. A flowering branch.
2. Petals separated.
3. Calyx with stamens and pistil.
4. Section of the same.
5. Fruit.
6. Section of the same.

(2–4 enlarged.)

M&N. Hanhart imp.

MYRIOXYLON PURPUREA. *Klotzsch*

N. Ord. LEGUMINOSÆ.

Tribe *Sophoreæ*.

Genus **Toluifera**,* *Linn.* (1742). B. & H., Gen., i, p. 558 (*Myroxylon*, Linn. f.); Baill., Hist. Pl., ii, p. 369; Klotzsch, in Bonplandia, 1857, pp. 272–277. Species 4 or 5 ? natives of tropical South America.

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83. Toluifera Pereiræ,† *Baill., Hist. Plant.*, ii, *p.* 383 (1870).

Syn.—Myrospermum Pereiræ, *Royle* (1853). Myroxylon Pereiræ, *Klotzsch*. Toluifera Balsamum, var., *Baill.*

Figures.—Pharmaceutical Journ., x (1850-51), pp. 280–282 (leaves and pods).

Description.—A tree attaining a height of about 50 feet, the trunk throwing out spreading ascending branches at 6 to 10 feet from the ground; bark of young branchlets purplish-grey, smooth, with white lenticels. Leaves alternate, without stipules, 6—8 inches long, pinnate with 6—10 alternate, shortly-stalked leaflets, readily disarticulating, rachis and thickish petioles (especially the latter) covered with a close felt of very short rufous hairs which is more dense on the buds and unexpanded leaves, leaflets 2—2¾ (usually about 2½) inches long by 1—1¼ wide, oblong-ovate, or sometimes slightly obovate, abruptly rounded at the base, with an attenuated, blunt, emarginate point often slightly twisted, entire but with the margin considerably puckered, slightly coriaceous, finely veined, midrib very prominent below; in the substance of the leaf between the smallest veins are more or less rounded or elongated glands or reservoirs which are transparent when the (dried) leaf is held against the light. Flowers numerous, on slender spreading pedicles ⅜ inch long, which readily separate from the axis above the very small bracts, laxly arranged in a long-stalked erect raceme 6 or 7 inches in length; rachis, bracts and pedicels all covered with a very short rufous tomentum; buds

* From affording Balsam of Tolu.

† Named in memory of Jonathan Pereira, M.D., F.R.S., the eminent author of 'Elements of Materia Medica,' and professor to the Pharmaceutical Society, who died in 1853.

ovoid, gibbous above. Calyx widely cup-shaped, shallow, with 5 very shallow, blunt teeth, rufous-tomentose outside, valvate. Petals 5, inserted perigynously near the base of the calyx, whitish, the posterior one (standard) with a long, linear-triangular, exserted claw, and an orbicular, veined, erect limb, the other four (wings and keel) similar, much smaller, linear-lanceolate, puckered, acute distant. Stamens 10, inserted in a ring with the petals, filaments slender, exserted, anthers nearly as long as filaments, equal, oblong, 2-celled, introrse, connective prolonged to form a short, sharp point. Ovary from the base of the calyx supported on a long stalk which carries it out beyond the calyx, short, smooth, compressed, with 1 or 2 ovules; style falcate, pointed. Fruit 3–4½ inches long, indehiscent, with a one-seeded cavity at its extremity, the stalk terete for about ½ inch, then laterally compressed and gradually widening to the seed-cavity, bordered on both edges, but chiefly on the ventral (upper) one, with a thick, chartaceous, stiff, flat wing, narrowest at the stalk end, and continued round the seed-cavity to the apiculus marking the position of the style on the ventral side, the whole outline of the legume somewhat falcate, pale brownish orange; pericarp rather loose and spongy, wrinkled externally, with two large reservoirs, filled with a liquid resin, in its substance, placed one on either side of the seed-cavity. Seed solitary, kidney-shaped, with a small radicle and large, convex, smooth cotyledons; no endosperm.

Habitat.—This Balsam-tree is found in woods on the Sonsonate coast or "Balsam Coast" of the state of San Salvador, Central America, formerly part of Guatemala; and in the neighbourhood of the small towns and villages in this country alone it is collected. A specimen labelled *M. Pereiræ* by the late D. Hanbury in the British Museum is from near Cordova, Mexico, collected by Finck in 1865, but has no fruit.

The identity of the genera *Toluifera*, L. (1742) and *Myroxylon*, Linn. f. (1781), was first we believe pointed out by Ruiz. The former name has undoubted priority, but has been generally set aside by authors, possibly on account of its adjectival form. We

cannot consider this as a sufficient reason for departing from the acknowledged rule in nomenclature, and have therefore employed the earlier name, as does also Prof. Baillon.

In Klotzsch's paper above quoted 8 species of *Myroxylon* are given, which it seems more correct to reduce to a considerably less number. Baillon, indeed, with much reason, now considers the present to be but a form of *T. Balsamum*, L. (*Myroxylon Toluifera*, H. B. K.), but we follow Hanbury in keeping them distinct, not having had the opportunity of examining good specimens of the latter.

The name "*Myrospermum Sonsonatense*, Pereira," used by Oersted and other writers for this plant, was never given by Pereira, who in his original account, referred to below, merely called the tree "*Myrospermum* of Sonsonate" for the purpose of distinction from other species.

Young plants of this tree may be seen in botanic gardens, but they have not flowered in this country.

Myroxylon peruiferum, Linn. f., long supposed to be the source of Balsam of Peru (as indicated by its name), is a distinct species. As there has been so much confusion in the nomenclature of plants of this genus it will be desirable to give some references to figures and descriptions. It has many synonyms and has been figured several times:—*Syn.*—Myrospermum peruiferum, *DC.*; M. pedicellatum, *Lam.*; M. erythroxylon, *Allemao*; Myroxylum pubescens, *H. B. K.* ?; Myroxylon pedicellatum, *Klotzsch.* M. robiniæfolium, *Klotzsch* ? *Figures.*—Nees t. 321 (poor); Lambert, Ill. Gen. Cinchona t. i, figs. 1 and 2, cop. in Steph. and Ch. t. 102 (flowers only); Hayne. xiv, t. 11; Berg and Sch., t. 29 e. This tree is a native of Ecuador, Peru, and Brazil, and yields a fragrant balsam not unlike Balsam of Tolu, called at Rio "Olea vermelho."

Pereira, in Pharm. Journ., x, pp. 230, 280; Royle, Materia Medica, ed. 2, p. 414; Klotzsch, in Bonplandia, 1857, p. 274; Hanbury, in Pharm. Journ., 1864, pp. 241, 315; Baillon, in Pharm. Journ., Nov., 1873, p. 382; Flück. & Hanb., Pharmacogr., p. 180; Bentham, in Fl. Brasil, fasc. 34, p. 310.

Official Part and Name.—Balsamum Peruvianum; a balsam obtained from Myroxylon Pereiræ, *Klotzsch* (B. P.). An oleo-resin (*Balsamum Peruvianum*), which exudes from the trunk of the tree after the removal of the bark, which has been previously scorched by fire (I. P.). Balsamum Peruvianum; an empyreumatic liquid balsam obtained from Myrospermum Peruiferum, *De Candolle* (U. S. P.).

Extraction and Commerce.—From information communicated by the late Dr. Charles Dorat, of Sonsonate, Salvador, to Professor Carson of the United States, and the late Daniel Hanbury, and published in the *American Journal of Pharmacy* and the *Pharmaceutical Journal*, it appears that Balsam of Peru is now obtained as follows:—Early in November or December, or after the last rains, the stems of the balsam trees are beaten on four sides with the back of an axe, a hammer, or other blunt instrument, until the bark is loosened; the four intermediate strips being left untouched in order not to destroy the life of the tree. The bruised bark soon cracks in long strips, and may be easily pulled off, when it is found to be sticky as well as the surface of the wood below it from a slight exudation of fragrant resin, but the quantity which thus flows is not worth collecting. In order, therefore, to promote an abundant flow, it is customary, five or six days after the bark has been beaten, to apply lighted torches or bundles of burning wood to the injured bark, which thus becomes charred; and after about eight days, the pieces of charred bark either fall off or are removed, and the stem commences to exude the balsam. This is collected by placing rags so as entirely to cover the bare wood, and as these become saturated with the balsam, which is of a light yellowish colour, they are collected and thrown into an earthenware boiler, three-quarters filled with water, and stirred and boiled gently until they appear nearly clean, and the now dark and heavy balsam sinks to the bottom. This process goes on for some hours, the exhausted rags being from time to time taken out and fresh ones thrown in; and after they are removed they are submitted to pressure by which much balsam is still obtained. The press consists of a small open bag about fourteen

inches long, made of stout pieces of rope fixed together with twine, open at the middle and looped at both ends to receive two sticks. The rags are placed inside the bag and the whole is twisted round by means of the sticks, and the balsam thus squeezed out. A washerwoman wringing out a wet cloth fairly represents the process. The balsam thus procured is added to that in the boiler. When the boiler has cooled the water is decanted, and the balsam is poured into *tecomates* or gourds of different sizes, and sent to the market. Sometimes, in order to purify the balsam, it is left for several days in the boiler, when the impurities float to the surface, and are skimmed off.

The second year the balsam is obtained from the same trees by bruising the bark, &c., that was left untouched in the previous year; and as the bark is renewed in two years, the same tree will yield an annual supply of balsam for very many years, provided a rest of five or six years be allowed at intervals of about twenty years.

Balsam of Peru is principally exported by way of Acajutla on the Pacific Coast; but also, to some extent, by Belize and other ports on the Atlantic side of Central America, whither it is brought across the country. Balsam of Peru is exclusively the produce of the state of Salvador in Central America. The balsam was originally supposed to be the produce of Peru, hence its name; an error which arose from its originally coming to Europe indirectly by way of Peru. The quantity of balsam now exported is uncertain, but some years since the annual produce was computed at about 25,000 pounds. Balsam of Peru was formerly exported in large earthenware jars, which were wrapped in straw, and sewed up in raw hide; but it is now usually imported in tin canisters or drums, which are much less liable to breakage.

General Characters and Composition.—Balsam of Peru is a viscid liquid, about the consistence of treacle, and of a nearly black colour when seen in bulk, but when examined in thin films, it is transparent, and of a deep orange or reddish-brown colour. It has an agreeable balsamic odour, which is more

especially observable when it is thinly spread on paper and warmed; its taste is warm and bitterish, and after being swallowed it leaves a disagreeable burning or pricking sensation in the throat. It is inflammable, and as it burns it gives off a whitish smoke and agreeable odour. Its specific gravity varies from 1·15 to 1·16. It is soluble in chloroform, and in about five parts of rectified spirit; but when mixed with water it undergoes no diminution of volume, although it yields to it traces of cinnamic and benzoic acids.

Balsam of Peru is composed of about 38 per cent. of a black, brittle, amorphous *resin*, which is odourless and tasteless, and which is soluble in caustic alkalies, and also in alcohol, and which by destructive distillation furnishes benzoic acid, styrol, and toluol; and of about 60 per cent. of *Cinnamein* or *Benzylic Cinnamate*, a brownish aromatic liquid,resolvable by the concentrated caustic alkalies into cinnamic acid and benzylic alcohol. It is probably owing to some alteration produced in the benzylic cinnamate by the process followed in obtaining the balsam, that its dark colour and the free acids which the balsam always contains are due.

Some naturally exuded resin of the balsam tree examined by Attfield, was found to contain 77·4 per cent. of resin which was without any aromatic properties, and contained no cinnamic acid; hence he concluded that it was quite distinct from Balsam of Peru, the one having no apparent relation to the other.

Medical Properties and Uses.—Balsam of Peru possesses stimulant and expectorant properties, and has been administered with success in chronic bronchitis, rheumatism, and asthma. It acts more especially on the mucous membranes, and hence it may be also employed to check excessive discharges, as in leucorrhœa, gleet, &c. It is also used as a stimulant application to indolent ulcers, bedsores, sore nipples, &c., and also in offensive discharges from the ear, &c. It is but little used, however, as a medicine either in this country or in the United States of America.

Balsam of Peru is sometimes employed in the manufacture of soap to which it imparts its fragrance, and also causes the soap to

wash with a soft creamy lather. Such soap is also regarded as useful in winter for chapped hands.

Other Products of the Balsam of Peru Tree.—Besides the true Balsam of Peru as now described, another balsamic substance is obtained in Salvador, by pressure without heat, from the fruit of the Balsam of Peru tree, after the removal from it of the fibrous portions of the epicarp and mesocarp. It is called *Balsamo blanco* (White Balsam) ; this has been sometimes confounded with Balsam of Tolu, from which, however, it is readily distinguishable. When first obtained this balsam is a yellow, semi-fluid, and somewhat granular substance ; which on standing separates into a whitish, opaque, crystalline, resinous deposit, and a superior translucent more fluid portion. Its odour is not particularly agreeable, but has been compared to melilot. White Balsam when examined by Stenhouse, yielded a neutral crystalline resin which he termed *Myroxocarpin ;* this occurs in the form of thin, colourless, tasteless prisms, an inch or more in length, insoluble in water, but soluble in hot alcohol or ether. White Balsam is scarce and valuable, and is not found in commerce.

Another product called *Balsamito* is obtained by digesting the fruit of the Balsam of Peru tree in rum. It is a clear liquid, having the colour of sherry, an odour resembling the tonquin bean, and a bitterish taste. It is regarded as stimulant, diuretic, and anthelmintic ; and is much used internally in colic, hysteria, &c. ; and as an external application to gangrenous or indolent ulcers, and as a wash to remove freckles from the face. It is not an article of commerce.

Per. Mat. Med., vol. ii, pt. 2, p. 307 ; Per. Mat. Med., by B. & R., p. 827 ; Pharmacographia, p. 181 ; U. S. Disp., by W. and B., p. 163 ; Piesse's Art of Perfumery, 3rd edit., p. 123 ; Amer. Journ. of Pharm., vol. xxxii, p. 303 ; Hanbury, in Pharm. Journ., vol. v, 2nd ser., pp. 241 and 315 ; Attfield, in Pharm. Journ., vol. v, 2nd ser., p. 248 ; Stenhouse, in Pharm. Journ., vol. x, 1st ser., p. 286.

DESCRIPTION OF PLATE.

Drawn from a specimen collected by Dr. Dorat at Izalco, San Salvador, in 1863, in the herbarium of the late D. Hanbury; the fruit added from specimens sent to Pereira from the Balsam Coast by M. Klee, in the British Museum.

1. A flowering twig with leaves.
2. Part of leaf seen by transmitted light.
3. Vertical section of a flower.
4. Legumes; one opened to show the seed.
5. Transverse section of the same, showing the resiniferous cysts.
6. A seed.

(2 and 3 enlarged.)

M & N Hanhart imp.

MOUREIRA BALSAMUM, Mart.

N. Ord. Leguminosæ.

Tribe *Sophoreæ*.

Genus Toluifera, *Linn.*

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84. Toluifera Balsamum, *Linn., Sp. Plant., ed.* 1, *p.* 384 (1753).

Balsamo.

Syn.—Myrospermum toluiferum, *A. Rich.* Myroxylum Toluifera, *H. B. & Kunth* (1823). Myroxylon peruiferum, *Ruiz* (in part) non *Linn. f.* M. punctatum, *Klotzsch.* M. Hanburyanum, *Klotzsch?*.

Figures.—Woodville, t. 215 (from Miller's imperfect specimens in Herb. Banks); Lambert, Ill. Gen. Cinch., t. 1, figs. 3 & 4, cop. in Steph. & Ch., t. 102 (fruit and seed); Nees, t. 322? (leaves only); Ramon de la Sagra, Hist. Cuba, Bot., t. 38 (1845); Hayne, xiv, t. 12 (*M. punctatum*).

Description.—A large tree 80 feet in height, with a straight, rather slender trunk, often bare of branches for 40—60 feet from the ground, and with a roundish spreading head; bark smooth, yellowish-grey or brown, with numerous white lenticels. Leaves shorter than in *T. Pereiræ*, with fewer, 4 to 7, leaflets, which are usually rather smaller, and often much recurved from base to apex, the margin not puckered, nor the rachis and petioles hairy, and the glandular reservoirs less evident except when young. Flowers on nearly smooth pedicels about $\frac{1}{2}$ inch long, rather densely arranged in a raceme about 4 or 5 inches long. Calyx broadly tubular or oblong-campanulate, about $\frac{1}{4}$ inch long, set obliquely on the pedicel, very minutely hispidulous, striate with very numerous parallel faint veins, thickened at the base, almost truncate at the mouth, which is usually faintly 3- (or 4-) lobed, the two upper lobes very broadly triangular, lateral, the lower one (composed of 3 more or less intimately combined) anterior. Petals as in *T. Pereiræ*, but the claw of the standard linear and the small petals not puckered. Filaments included in the calyx, anthers versatile. Fruit larger than in the last, 4 or 5 inches long, scarcely falcate, the terete stalk shorter, and suddenly widened into the wing, which is nearly the same width for its

whole length, but slightly widest at about the middle. Seeds as in *T. Pereiræ*.

Habitat.—A native of Venezuela and New Granada; in the former country it grows near Caracas, where it has been collected by Linden, Goering and others, and on the Tucuyo River, where Seemann found it to be extremely common; in New Granada it was gathered by Houston near Carthagena at the beginning of the 18th century, and Weir has lately brought specimens from Plato, on the Rio Magdalena, near which place the tree is found plentifully in the forests. It is also met with in Peru, if we are right in considering *Myroxylon punctatum*, Kl., as the same species, and probably also in Ecuador and Brazil, but we have seen no specimens from the two latter countries. In Cuba, where the tree was found by Dr. Morales, it is considered to have been introduced. The Balsam is collected only in New Granada, and takes its name—Tolu—from a small district near Carthagena.

The above description is made from the excellent specimens brought from Venezuela by Mr. Goering (preserved in brine), now in the Pharmaceutical Society's museum. The examination of these appears to confirm the late D. Hanbury's opinion of the distinctness of this species from *T. Pereiræ*. In addition to the characters pointed out by him it will be noticed that the calyx is much longer and more tubular, and includes the filaments.

We cannot detect sufficient characters in the Peruvian *M. punctatum*, Klotzsch, to warrant its separation from the present plant. This is the "Quino-quino" tree of Peru, where it was collected by Ruiz and Pavon, from whom is a large series of specimens in the British Museum labelled "*Myrospermum balsamiferum*, Fl. Per. ined." It is the fruit of this which is figured by Lambert (l. c.) in his plate of *M. peruiferum*.

The Balsam of Tolu was raised "at the Physick Garden, Chelsea," by Miller before 1736 from seeds sent from Carthagena by Dr. Houston, and specimens of the flowers and leaves are contained in the Sloane and Banksian herbaria in the British Museum. It has in recent times been several times grown

from seeds, and young specimens may be seen at Kew and elsewhere.

There are leaves only of *M. Hanburyanum*, Klotzsch, in the herbarium of the late D. Hanbury, collected in Peru by Humboldt and by Warszewicz, and they are probably referable to the present species.

Miller, Gard. Dict., ed. 8 (1768); Klotzsch, in Bonplandia, 1857, p. 277; Bentham, Fl. Bras., fasc. 34, p. 309; A. Rich., Fl. Cuba, i, p. 397; Lindl., Fl. Medica, p. 279; Flück. & Hanb., Pharmacogr., p. 177.

Official Part and Name.—Balsamum Tolutanum; a balsam obtained from Myroxylon Toluifera, *H. B. & K.* (B. P.). A Balsam (*Balsamum Tolutanum*) obtained from the stem by incision (I. P.). Balsamum Tolutanum; a semi-liquid balsam obtained from Myrospermum Toluiferum, *De Candolle* (U. S. P.).

Extraction and Commerce.—The latest and best information in reference to the extraction of Balsam of Tolu is that derived from Mr. Weir, who visited New Granada in 1863 as plant collector to the Royal Horticultural Society of London. Mr. Weir has described the manner of collection as he observed it in the mountainous forests, about twenty miles from Plato, a port on the right bank of the river Magdalena. The balsam is procured by making two deep sloping incisions quite through the bark to the wood, and meeting at a sharp angle at their lower ends. The bark and wood is then a little hollowed out immediately below this V-shaped incision, and a calabash cup, about the size and shape of a deep tea-cup, is inserted under it in order to receive the balsam as it exudes from the incision. The process is repeated all over the trunk, at close intervals, up as high as a man can reach, so that as many as twenty calabash cups may be frequently seen at one time on the same tree. When the lower part of the trunk is too full of wounds and scars for any fresh cuts to be made, a rude scaffold is sometimes erected, and a new series of incisions made higher up. From time to time, as may be necessary, the balsam gatherer goes round to the trees with a pair of flask-shaped bags made of raw hide slung over the back of a

donkey, and empties into them the contents of the calabash cups, and the cups are then replaced in their former positions, and left to be again filled. The balsam is sent down to the ports on the river in these bags, where it is transferred to the cylindrical tins in which it is commonly exported to Europe and other parts. The bleeding of the trees for collecting the balsam goes on for at least eight months of the year, that is, from July to March or April; and when the balsam is flowing well it is said that "one moon" suffices to fill the cups.

From information furnished by another traveller to the authors of Pharmacographia, it appears that it is customary in some districts, to let the balsam flow down the tree into a receptacle formed at its base of the large leaf of a species of *Calathea*.

The balsam is collected entirely in New Granada, in the Montaña around Plato as above described, and near other small ports on the right bank of the Magdalena; and also, according to Hanbury, in the Sinu valley, and in the forests between that river and the Cauca. The tins in which it is now usually exported from New Granada contain about ten pounds of the balsam, but some are of larger size, holding as much as twenty-five pounds. Formerly the balsam used to be forwarded to Europe and other parts, in small calabashes.

General Characters and Composition—When freshly imported Balsam of Tolu has a soft and tenacious consistence, which, however, varies much with the temperature; but by keeping it gradually hardens, and becomes brittle, like resin, in cold weather; and when very old it exhibits, when broken, a crystalline appearance. This brittle balsam is easily softened by the heat of the hand. Balsam of Tolu is transparent in thin layers, has a yellowish-brown or sometimes reddish-brown colour; a highly fragrant odour, especially when warmed; and a somewhat sweetish, slightly aromatic, not unpleasant taste. When heated it readily melts, inflames, and diffuses an agreeable odour. It is readily soluble in alcohol, chloroform, or solution of potash; but is less soluble in ether, and but slightly so in volatile oils.

This balsam, although obtained from a very nearly allied species

to that yielding Balsam of Peru, from being a natural exudation differs a good deal in chemical composition from that substance. Its constituents are said to be an *amorphous resin*, which is generally regarded as identical with the black brittle resin described by us when treating of Balsam of Peru; a large quantity of acid, which is said by Carles to be simply *cinnamic acid*, and not, as formerly stated, a mixture of this acid with benzoic acid; and of about 1 per cent. of *tolene*, a volatile oil obtained by distilling the balsam with water. No cinnamein or styracin is found in Balsam of Tolu; but by destructive distillation it affords the same substances as Balsam of Peru under similar treatment.

Adulteration.—Balsam of Tolu is rarely adulterated in this country, but common resin or colophony is sometimes mixed with it. This adulteration may be readily detected by bisulphide of carbon, which only extracts from the pure balsam its cinnamic acid, but it entirely dissolves common resin. A factitious Balsam of Tolu has been, however, described by Mattison in the United States; this was found to be essentially composed of 63 per cent. of "a balsam prepared from the bark of *Liquidambar orientale*, which, upon being treated with hot petroleum benzin, yielded a copious deposit of crystals of styracin upon cooling;" and about 11 per cent. of bark and charred ligneous matter. The remaining 26 parts appeared to be Balsam of Tolu.

Medical Properties and Uses.—Balsam of Tolu possesses stimulant and expectorant properties like that of Balsam of Peru, and may be used in similar cases. As a remedy it is, however, more frequently employed than the latter balsam. It is also often used as an agreeable flavouring adjunct to pectoral mixtures. Although one of the mildest of the stimulating balsams, its use is contra-indicated until after the reduction of inflammatory action. The vapour of the ethereal solution of the balsam has been inhaled with much benefit in old and obstinate coughs. In the form of lozenges it is a popular and agreeable remedy for appeasing troublesome coughs.

It is sometimes used by the perfumer, and when dissolved in alcohol it makes, on account of the permanence and agreeable

nature of its odour, a good basis for a bouquet. It may also be used to give a pleasant odour to lip-salve.

Per. Mat. Med., by B. & R., p. 831; Pharmacographia, p. 178; U. S. Disp., by W. & B., p. 165; Weir, in Proc. of the R. Hort. Soc. for May, 1864, and Pharm. Journ., vol. vi, ser. 2, p. 60; Ulex, Archiv der Pharm., Jan., 1853; Journ. de Pharm., ser. 3, vol. xi, p. 426; Amer. Journ. Pharm., vol. xv, p. 77; Carles, Journ. de Pharm., vol. xix (1874), p. 112, and Proc. Amer. Pharm. Assoc., vol. xxii, p. 149; Mattison, in Amer. Journ. Pharm., 1876, p. 52, and Brit. Year Book Pharmacy for 1876, p. 188.

DESCRIPTION OF PLATE.

Drawn from specimens in the museum of the Pharmaceutical Society, collected in Venezuela by Goering; the fruit added from a specimen in the British Museum (*M. punctatum*), collected in Peru by Pavon.

1. A branch with leaves and flowers.
2. A flower.
3. Petals.
4. Stamens.
5. An anther.
6. A legume.
7. A seed.
8. The same, with one cotyledon removed.

(2–5 enlarged.)

D Blair ad nat. del. et lith.

CÆSALPINIA BONDUCELLA *Roxb.*

M & N Hanhart imp.

N. Ord. LEGUMINOSÆ, *Cæsalpinieæ*.

Tribe *Eucæsalpineæ*.

Genus Cæsalpinia,* *Linn.* B. & H., Gen., i, p. 565. Baill., Hist. Pl., ii, p. 170. About 40 species are known, dispersed throughout the hotter regions of the globe.

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85. Cæsalpinia Bonducella,† *Roxb., in Asiatic Researches*, xi, *p.* 159 (1810).

Syn.—Guilandina Bonducella, *Linn.* G. Bonduc, var. *DC.*

Figures.—Rheede, Hort. Malabar., ii, t. 22; Rumph., Herb. Amboin., v, t. 48, 49; Gaertner, Fruct., ii, t. 148 (fruit).

Description. — A woody climber; stem cylindrical, slender, pubescent, more or less beset with short, straight, conical, sharp, unequal prickles, sparingly branched, with a large white pith. Leaves very large, 1—2 feet long, widely spreading, bipinnate. Stipules large, composed of 2 or 3 rounded leaflets; rachis stout, cylindrical, pubescent, with scattered backwardly hooked prickles, usually in pairs, on the under surface, pinnæ in about 5—9 opposite pairs without an odd one, coming off from the upper surface of the rachis, leaflets in about 7 opposite pairs, with two hooked prickles at the base of each pair, very shortly stalked, 1—1¾ inch long, oblong-ovate, rounded at the base, bluntly pointed and with a sharp mucro at the apex, entire, pubescent at the margin and on the midrib or all over beneath. Flowers rather small, numerous, on spreading pedicels nearly ½ inch long, rather densely arranged in pyramidal, long-stalked racemes; bracts linear, their long points recurved over the unopened buds, early caducous; rachis rusty-pubescent. Calyx large, deeply divided into 5 oblong, blunt, strongly rufous-pubescent, imbricate lobes, the two lower somewhat larger. Petals 5, about half as long again as the calyx, spreading, oblong, blunt, yellow, the upper

* In commemoration of Andrea Cæsalpini, a native of Arezzo, and the founder of systematic botany. His great work was published at Florence in 1583, and he died in 1603.

† *Bonducella*, diminutive of *Bonduc*, from Bunduk, the Arabic name for the seeds.

spathulate one rather the shorter, and sometimes spotted with red. Stamens 10, quite free, inserted at the base of the calyx and about equalling it in length, the upper one shorter, filaments dilated and hairy below. Ovary sessile, hairy, style short, stigma truncate, hollowed. Pod about 2½—3 inches long, shortly stalked, very broadly oval, rounded at both ends, tipped with the persistent style, laterally compressed, bright orange-brown, covered with numerous, straight, sharp, erect spines ¼—⅓ inch long, 2-valved, valves leathery, white internally. Seeds 2 or 1 in the pod, subglobular, slightly compressed, ½—¾ inch in diameter, smooth, but ringed with slightly marked parallel lines, pale greenish-grey, shining, testa hard and rather thick ; embryo with two large plane-convex cotyledons, no endosperm.

Habitat.—Common on or near the sea-coast of tropical countries, as throughout India, the Indian Archipelago, the Pacific Islands, N. Australia, the East and West Coast of Africa, Brazil, and the West Indies. It climbs over other plants by the hooked prickles of the leaves, which are different from those of the stem, the latter being straight and not adapted for hold-fasts. The long cylindrical rachis of the leaf has much the appearance of a branch. There is a living specimen in the collection at Kew.

The nearly allied *C. Bonduc*, Roxb., is distinguished by its larger size, by being much less hairy, having no stipules, erect bracts, and yellow seeds. It is found, less generally distributed, in tropical Asia and America.

Roxb., Fl. Indica, ii, p. 357; DC. Prod., ii, p. 480; Oliver, Fl. Trop. Africa, ii, p. 263; Lindl., Fl. Medica, p. 263.

Official Part and Name.—Bonducellæ Semina ; the seeds (I. P.). Not official in the British Pharmacopœia, or the Pharmacopœia of the United States.

General Characters and Composition.—Besides the name of Bonduc by which these seeds are generally known, they are also termed *Grey Nicker Seeds* or *Nuts*, and *Guilandina Seeds.*

Bonduc seeds are of an irregular rounded or ovoid form, somewhat compressed, from about half an inch to three quarters of an inch in diameter, and weigh from twenty to forty grains. Their surface is smooth and polished, and generally blueish or greenish-grey, or rarely, of a pale greyish-brown colour; but marked at intervals by very slightly elevated irregular concentric ridges of a darker tint. At one end the hilum is seen as a small scar, or rarely the short remains of the stalk may be there found, and around this hilum the surface is marked by an irregular roundish dark brown blotch. The shell is hard and thick, and constitutes at least half the weight of the seed; it is broken with difficulty, and its fractured surface beneath the external greyish covering has a pale reddish tint. Internally the shell is lined by a whitish integument. The nucleus or kernel is readily separated from the shell, and has a whitish or pale yellowish-white colour, and a somewhat waxy texture. The seed has no perceptible odour, and the shell is without any marked taste; but the nucleus when chewed is agreeably bitter.

No complete analysis of these seeds has been published, but the testa is said to contain *tannic acid,* and the nucleus a *fixed oil, resin,* and a *bitter principle,* which is doubtless the active constituent. From a chemical examination of these seeds by the authors of Pharmacographia, they "infer that the active principle of the Bonduc seed is a bitter substance not possessing basic properties."

Medical Properties and Uses.—Bonduc seeds are regarded in India as tonic and antiperiodic, although the reports in reference to their action are somewhat conflicting. They have been employed with success in intermittent fevers, especially in those of the natives of India; and also generally in debility and other cases where tonics are necessary. The powdered kernels are either given alone; or combined with chiretta and other Indian tonics; or mixed with powdered black pepper, as in the Compound Powder of Bonduc of the Pharmacopœia of India. Ainslie states that the kernels, when powdered small, and mixed with Castor Oil, form a valuable external application in incipient

hydrocele ; but no recent medical practitioner has appeared to notice any benefit from their use in this affection.

The fatty oil obtained from the nucleus of the seeds is likewise employed in India. It is reputed to be useful in convulsions and paralysis, and also for other purposes.

Dr. Kirkpatrick and other practitioners regard Bonduc root, especially its bark, as more valuable than the seed, in the treatment of intermittents, and for use generally as a tonic.

Besides the use of Bonduc seeds in medicine, they are commonly, from their hard and polished nature, strung into necklaces, rosaries, bracelets, &c.

Ainslie's Mat. Med., Hind., p. 81 ; Pharmacopœia of India, pp. 69 & 446; O'Shaughnessy, Bengal Dispensatory, p. 311; Pharmacographia, p. 185 ; Waring, Bazaar Medicines, Travancore, 1860, p. 18 ; Johnson, Rép. Ph., vol. xix, p. 296 ; Lindley, Fl. Med., p. 156.

DESCRIPTION OF PLATE.

Drawn from a specimen in the British Museum, collected at Hongkong by Mr. Lamont.

1. Portion of a branch with fruit, one opened to show the seed.
2. Section of seed.
3. A flower.
4. Calyx.
5. A stamen.
6. Upper part of a leaf.

(3–5 enlarged.)

HÆMATOXYLON CAMPECHIANUM, L.

N. Ord. Leguminosæ.

Tribe *Eu-cæsalpineæ*.

Genus Hæmatoxylon, *Linn.** B. & H., Gen., i, p. 567; Baill., Hist. Pl., ii, p. 164. A genus consisting of but a single species.

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86. Hæmatoxylon campechianum, *Linn., Sp. Pl., ed.* 1, *p.* 384 (1753).

Logwood. Peachwood.

Figures.—Woodville, t. 163; Hayne, x, t. 44; Nees, t. 342; Sloane, Hist. Jamaica, t. x, figs. 1–4; Karsten, Fl. Columbiana, t. 114; Tussac, Fl. Antilles, iv, t. 36; Baill., l. c., figs. 49–51.

Description.— A small spreading tree, with very crooked branches covered with a dark rough bark, in the smaller smooth twigs beset with small white dots. Leaves alternate, or apparently fasciculate on stunted branches, pinnate, with 4 (rarely 5) pairs of opposite, shortly stalked, obcordate, smooth, uniform leaflets (rarely bipinnate); stipules small, membranous, usually caducous, but in wild and stunted trees persistent, and forming strong sharp spines. Flowers small, in lax axillary racemes exceeding the leaves, on longish pedicels, which are articulated with the axis; bracts minute. Calyx very deeply divided into 5 broad rounded segments, the anterior one longer than the others, glabrous, purple. Petals 5, forming a nearly regular corolla, spreading, slightly exceeding the calyx-segments, obovate-lanceolate, smooth, yellow, inserted in the mouth of the short cup-shaped tube of the calyx. Stamens 10, inserted with the petals, free, nearly equal, a little longer than the petals, filaments hairy below; anthers small, similar, dehiscing longitudinally. Pistil shortly stalked from the base of the calyx-tube; ovary narrow, compressed, with 2 or 3 ovules; style elongated, filiform, terminated by the small capitate stigma,

* Name from αἷμα, blood, and ξύλον, wood, in allusion to the colour of the duramen.

projecting beyond the stamens. Pod membranous, lanceolate, compressed, pointed at both ends, 1- or 2-seeded, dehiscent not along the sutures but down the centre of each valve, so as to form two boat-shaped pseudo-valves. Seed transversely oblong, flattened, attached by the centre of its inner border; embryo with two very large cotyledons, each divided into two lobes which are reflected over the sides of the cylindrical radicle; no endosperm.

Habitat.—The Logwood inhabits tropical America, especially the shores of the Gulf of Campeachy (whence it gets its specific name), Honduras, and Columbia. It has become perfectly naturalized in the West Indian islands, having been introduced into Jamaica in 1715, as well as in other tropical countries. Miller successfully cultivated it in England in 1739, and it has since been frequently grown here, and may be seen in most botanical gardens, though it very rarely flowers.

DC., Prod., ii, p. 485; Grisebach, Fl. Br. W. Indies, p. 204; Lindl., Fl. Med., p. 264.

Official Part and Name. — HÆMATOXYLI LIGNUM; the sliced heart-wood (B. P.). The heart-wood (*Hæmatoxyli Lignum, Logwood*) (I. P.). HÆMATOXYLON; the heart-wood (U. S. P.).

Production and Commerce.—The logwood tree is usually felled when about ten years old; the bark and sap-wood (*alburnum*) are then chipped off, after which the red heart-wood (*duramen*) which remains is cut into logs about three feet long, which are alone exported, and constitute the logwood of commerce. Four kinds of logwood are distinguished in the London market, under the names of Campeachy, Honduras, St. Domingo, and Jamaica, which are arranged in the order of their value. The average imports into the United Kingdom in the years 1870, 1871, 1872, and 1873, were about 50,000 tons, representing a money value of above £250,000.

General Characters and Composition.— The logs are dense, tough, and about the specific gravity of 1·057. Externally, by exposure to the air, they acquire a blackish-red colour; internally

they are reddish-brown. For use in pharmacy and in other ways, logwood is found in *chips ;* these have a reddish-brown colour, and a slight peculiar agreeable odour, which has been compared to sea-weed, and a sweetish astringent taste. When chewed logwood imparts to the saliva a brilliant dark reddish-pink colour.

Logwood was analysed as far back as 1810 by Chevreul, who found among other substances a *volatile oil, tannic acid,* and a peculiar principle on which the colouring properties of the wood depend, called *hæmatoxylin* or *hématin.* This principle has been since examined by Erdmann and O. Hesse. Hæmatoxylin when quite pure, is colourless or nearly so, and forms white crystals either with one or three equivalents of water; it is very soluble in hot water and alcohol, but only sparingly so in cold water and ether. It has a sweet taste, resembling liquorice. When exposed to the air under the influence of alkalies, hæmatoxylin becomes red. It is sometimes found crystallised in clefts of the wood. The substance known as *hæmatein* is produced from *hæmatoxylin* by extraction of 2 equivalents of hydrogen, a change which takes place by the action of oxygen under the influence of alkalies. Hæmatein occurs in the form of dark violet crystalline scales, which exhibit a fine green hue, an appearance frequently to be noticed on the surface of logwood chips. The decoction of logwood is deep red; acids render it paler and brighter coloured; and the alkalies give it a purplish or violet-blue colour.

Medical Properties and Uses.—Logwood is a mild astringent. When given internally it speedily becomes absorbed, and may be detected in the urine and stools. Its long-continued use has sometimes been followed by phlebitis, hence some caution is necessary in its employment. It has been found useful in chronic diarrhœa and dysentery, in some forms of atonic dyspepsia, and especially in the diarrhœa of infants. As an injection the decoction of logwood has been found of service in leucorrhœa; and in the form of an ointment prepared from the extract of logwood, it is said to be useful in cancer and hospital gangrene.

The principal use of logwood is, however, in dyeing, where it is employed in the production of violet and blue colours, certain

shades of grey, and more especially blacks, to which latter it gives a lustre and velvety cast.

Pharmacographia, p. 187; Garr., Mat. Med., p. 241; Per., Mat. Med., vol. ii, pt. 2, p. 346; Annal. de Chimie, 80 (1812), p. 128; Watts, Dic. Chemistry. vol. iii, pp. 1, 4, and 732; U. S. D., by W. & B., p. 446.

DESCRIPTION OF PLATE.

Drawn from a specimen in the British Museum, collected in Jamaica by Dr. Wright; the fruit added from Hayne.

1. Calyx and pistil.
2. Vertical section of flower.
3. Fruit.
4. The same, showing dehiscence.
5. A leaflet.

1
3
2
4

D Blair FLS ad nat del et lith

M&N Hanhart imp

CASSIA FISTULA, *Linn.*

N. Ord. Leguminosæ, *Cæsalpinieæ*.

Tribe *Cassieæ*.

Genus Cassia,* *Linn.* B. & H., Gen., i, p. 571; Baill., Hist. Plant., ii, p. 187; Bentham, in Trans. Linn. Soc., xxvii, p. 503. Species about 340, widely dispersed through the warm and tropical regions of both worlds.

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87. Cassia Fistula,† *Linn., Sp. Plant., ed.* 1, *p.* 377 (1753).

Purging Cassia. Indian Laburnum.

Syn.—C. excelsa, *H. B. & K.* C. rhombifolia, *Roxb.* Cathartocarpus Fistula, *Pers.* Bactyrilobium Fistula, *Willd.*

Figures.—Woodville, t. 160; Nectoux, Voyage dans la Haute Egypte, t. 4, cop. in Hayne, ix, t. 39; Steph. & Ch., t. 155; Nees, t. 344; Baillon, Hist. Pl., ii, fig. 103-5.

Description.—A tree, 30—50 feet high, with a straight trunk and spreading slender cylindrical branches, with a smooth ash-grey bark. Leaves alternate, on long stalks with minute stipules, over a foot in length, abruptly pinnate; leaflets in 3 to 7 opposite or nearly opposite pairs, on short rugose stalks articulated with the rachis, 2—6 inches long, ovate, tapering at both ends but obtuse at the apex, entire, rather thick, quite smooth, shining above, bright green, paler beneath. Flowers large, 1—2 inches across, on long, spreading, slender, smooth pedicels, very laxly arranged on stalked pendulous racemes a foot or more in length; bracts lanceolate, very quickly falling. Calyx very deeply divided into 5 almost distinct, nearly equal, oblong-oval, very obtuse, concave, glabrous, imbricate segments. Petals 5, spreading, nearly equal, roundish or broadly oval, shortly clawed, concave, veined, bright dark yellow, imbricate the upper one internal. Stamens 10, hypogynous, distinct, very unequal, the 3 upper very small, erect, with indehiscent anthers, the 4 lateral (2 on each side) with straight slender filaments about $\frac{3}{8}$ inch long, and large versatile anthers

* *Cassia*, or κασία, was the classical name of a bark allied to Cinnamon, also called "*Cassia fistula*." The latter name became in the middle ages applied to the pods of the present plant, and later to the plant itself.

† *Fistula*, a tube or pipe.

dehiscent at the base by pores, the 3 lower with strongly arched filaments about $1\frac{1}{2}$ inches long, projecting in the front of the flower and doubled into a loop at the base, and rather smaller oblong anthers dehiscing longitudinally. Ovary stalked, slender, curved downwards and arched like the anterior stamens which it nearly equals in length, style short, stigma terminal. Pods pendulous, 1—2 feet long, $\frac{1}{2}$—1 inch in diameter, cylindrical, shortly stalked, suddenly contracted into a blunt point, straight or slightly arched, nearly smooth but with faint transverse striations, dark purplish-brown, indehiscent, but with the dorsal and ventral sutures distinctly marked by horizontal smooth lines running along the whole length, very hard, containing numerous (25—100) seeds each immersed in a dark-coloured pulp and completely separated by thin flat transverse partitions. Seed rather small, about $\frac{1}{3}$ inch long, attached by a very slender funicle, horizontal, ovoid, somewhat compressed, testa very hard, smooth and shining, pale orange-brown, marked down one flattened surface by a raised line (raphe), embryo with large flat foliaceous veined cotyledons and a short radicle, placed transversely and somewhat crumpled in the abundant hard horny endosperm.

Habitat.—This very handsome tree is a native of tropical parts of Asia. It is truly indigenous (as well as much planted) in many parts of peninsular India, Ceylon, Java and the Philippines, growing especially on the lower hills, and ascending to 4000 feet. In tropical and sub-tropical Africa it is now found apparently wild in many places, and is possibly indigenous, though undoubtedly usually a planted tree; it is frequent under such circumstances in Egypt. In the New World it has no doubt been introduced, and the beauty and fragrance of its flowers has caused it to be a favourite tree for planting in the West Indian Islands, especially Jamaica, in Central America, and Brazil. The showy flowers appear in May and June, and the large pods are ripe in the following February or March. There are young plants in the botanic gardens at the Regents Park, Edinburgh, and Dublin, and the tree was grown in this country by Miller so long ago as 1731.

The seeds in the fresh pods are immersed in a pulp; in the dry fruit this has dried up and become reduced to a soft layer, nearly black in colour, which lines and covers the whole surface of each compartment.

The subgenus *Fistula*, to which this species belongs, is characterised by the peculiar pod and by the staminal arrangement. There are twenty species, all tropical. One of these is *Cassia moschata*, H. B. & K., a native of New Granada; its pods are rather smaller than those of *C. Fistula*. There is a good figure in Trans. Linn. Soc. xxiv, t. 26.

DC. Prod., ii, p. 490; Roxb., Fl. Ind., ii, p. 334; Benth., in Trans. Linn. Soc., xxvii, p. 514; Grisebach, Fl. Brit. W. Indies, p. 206; Lindl., Fl. Med., p. 514; Brandis, Forest Fl., p. 164.

Official Parts and Names.—Cassiæ Pulpa; the pulp obtained from the pods (B. P.). The pulp of the pods (I. P.). Cassia Fistula; the fruit (U. S. P.).

1. Cassia Fistula.—*General Characters.*—The botanical characters of this fruit have been already given. The pods or fruits of commerce vary in length from 1½ to 2 feet, and in diameter from ¾ to 1 inch; and each encloses from 25 to 100 seeds. Each cell or cavity is completely filled up in the recent fruit by a solitary smooth flattish oval seed, of a reddish-brown colour, imbedded in a soft viscid pulp; but in the pods of commerce the seeds appear free from the pulp, which is only found as a thin layer covering the inner surface of the cells. Those pods yield the most pulp which are heavy, and do not rattle when shaken.

Commerce.—Cassia fistula is imported from both the East and West Indies, but principally from the latter.

2. Cassiæ Pulpa.—*General Characters, Commerce, and Composition.*—Cassia pulp has a viscid consistence, blackish-brown colour, shining appearance, sickly odour, and a sweet taste. As ordinarily found it contains the seeds, and the partitions or dissepiments, which are placed between them in the entire fruit; these should be removed in making preparations from it.

The pulp is sometimes imported *per se* from the East Indies; but as by exposure to the air it becomes acid in consequence of undergoing the acetous fermentation, it is best used soon after its extraction from recently imported pods.

No peculiar principle has been obtained from cassia pulp, but it appears to contain *sugar, tannic matter, albuminoids, starch, oxalate of calcium,* and some other unimportant constituents.

Medical Properties and Uses.—The pulp, which is the only part employed in medicine, is a mild laxative. It is much esteemed in some parts of the South of Europe, but is little used in this country or in the United States, except as an ingredient in the well-known pleasant and useful laxative preparation termed Lenitive Electuary or Confection of Senna. In large doses it is purgative; but when given alone for this purpose it is apt to cause nausea, griping, and flatulence.

Substitutes for Cassia Fistula. — The pods of two other species of Cassia have been occasionally imported, and used for similar purposes as Cassia Fistula; namely, those of Cassia moschata, *H. B. K.*, and those of Cassia grandis, *L. f* (C. Brasiliana, *Lamarck*). The former are obtained from a tree which is a native of New Granada; they have been described particularly by Hanbury, who states they are known in their native country as *Cañafistola de purgar.* The pods are smaller and not so straight as those of Cassia Fistula, but otherwise they have a close resemblance to them. Their pulp is sweetish and astringent, and of a bright brown hue. Hanbury regards the pods of this species as constituting the *Small American Cassia* of the French pharmaciens; and says that its astringent pulp would render its substitution for the ordinary official cassia undesirable.

The pods of *Cassia grandis,* which is a native of Central America and Brazil, are of much larger size than those of *Cassia Fistula,* being sometimes as much as an inch and a half in their largest diameter. They are very rough on their outer surface, and instead of presenting the bands or furrows of the common Cassia Fistula, they are marked by three longitudinal elevated ridges. The pulp has a bitter and astringent taste. It is some-

times used in veterinary practice, and hence is known as Horse Cassia.

Per. Mat. Med., vol. ii, pt. 2, p. 362; Pharmacographia, p. 196; U. S. Disp., by W. & B., p. 236; Hanbury, in Linn. Trans., vol. xxiv, p. 161, and Pharm. Journ., ser. 2, vol. v, p. 348.

DESCRIPTION OF PLATE.

Drawn from a specimen in the British Museum from the Calcutta Botanic Garden (Wallich, no. 5302).

1. A flowering branch.
2. Petals.
3. The pistil and stamens (4 of the latter removed).
4. Half of a legume.
5. Terminal portion of the same, vertically bisected.
6. A seed.
7. Embryo, one cotyledon removed.

D.Blair F.L.S. ad nat. del. et lith.

CASSIA MARILANDICA, *Linn.*

M&H Hanhart imp

N. Ord. LEGUMINOSÆ, *Cæsalpiniceæ*.

Tribe *Cassieæ*.

Genus **Cassia**, *Linn.*

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88. Cassia marilandica, *Linn., Sp. Plant., ed.* 1, *p.* 378 (1753).

Wild Senna (United States).

Figures.—Barton, t. 12; Bigelow, t. 39; Nees, t. 349; Dillenius, Hort. Eltham., t. 359.

Description.—A perennial herb, with a more or less horizontal, woody, contorted rootstock giving off numerous black roots. Stem 3 or 4 feet high or more, erect, cylindrical, striate, smooth or nearly so. Leaves alternate, 6—8 inches long, abruptly pinnate, widely spreading, long-stalked; rachis curved upwards, tapering, cylindrical, with a few scattered bristly hairs, swollen at the base on the upper surface of which is a conspicuous, stalked, ovoid gland; stipules petiolar, setaceous, about $\frac{3}{8}$ inch long, hairy, soon falling; leaflets shortly stalked, opposite, in about 8 pairs, 1—$1\frac{1}{2}$ inch long, the basal ones rather the smaller spreading and often pointing backwards, the others drooping, all oval-oblong, entire, apiculate, glabrous, bright pale green, paler and glaucous beneath. Flowers of moderate size, on rather long slender, hairy pedicels, arranged in short, crowded, stalked, axillary and terminal racemes shorter than the petioles; buds nodding; bracts linear, with long curved points overtopping the young buds, but soon caducous. Sepals 5, imbricate, unequal, the two outer smaller, broadly oblong-oval, very blunt, strongly reflexed when fully expanded, glabrous, without veins, pale yellowish-green. Petals 5, imbricate in the bud, widely spreading and distant when fully expanded, unequal, the posterior (upper) one the shortest, the two anterior (lower) ones the longest, all obovate-spathulate, concave, veined, pale orange-yellow, becoming white when withering. Stamens 10, hypogynous, distinct, unequal, filaments flattened, yellow, anthers very dark purplish brown, the 3 upper very short, truncate and indehiscent, the 3 lower about $\frac{1}{4}$ inch

long (the middle one the shortest), strongly curved upwards, dehiscing by terminal pores, the 4 lateral intermediate in size, nearly straight, with terminal pores. Ovary not stalked, slender, curved, densely covered on both sides with long white hairs, style long, tapering, strongly curved upwards, smooth. Pods about 3 inches long, linear, somewhat pendulous, slightly curved, strongly compressed laterally, smooth or slightly pilose, dark brown, tipped with the curved style, constricted on the sides between each pair of seeds. Seeds numerous, 40 or more, small, clavate, flattened, smooth, dark brown.

Habitat.—This species of *Cassia* is common in low sandy ground, on river-banks, and similar places through all the United States of America, flowering in July and August. It was introduced into English gardens in 1723 and is not unfrequently cultivated as an ornamental plant.

DC. Prod., ii, p. 498; A. Gray, Man. Bot. U. States, p. 144; Chapman, Fl. South. States, p. 114; Benth., in Trans. Linn. Soc., xxvii, p. 534; Lindl., Fl. Med., p. 261.

Official Part and Names.—CASSIA MARILANDICA; the leaflets (U. S. P.). It is also called American Senna. It is not official in the British Pharmacopœia, or the Pharmacopœia of India.

Collection.—For medicinal use, American Senna should be collected towards the close of the summer in August, or at the beginning of autumn in September, and then carefully dried.

General Characters and Composition.—American Senna, as seen in commerce, consists of leaflets which vary in length from about an inch to nearly two inches, and in breadth from a quarter to half an inch. In shape they are oval-oblong or oblong-lanceolate, entire, and commonly mucronate-pointed. The leaflets are thin, somewhat flexible, of a pale green colour, a feeble odour, and a bitterish-sweet, nauseous taste, somewhat resembling that of Alexandrian or East Indian Senna. American senna is commonly found in the shops in the form of oblong cakes, which usually consist of leaflets, petioles, and flowers, compressed together into a mass.

No recent analysis of American Senna has been made, but from its physiological action it doubtless owes its activity to the

presence of *cathartic acid*, which is fully described under *Cassia acutifolia*.

Medical Properties and Uses.—American senna is regarded by practitioners in the United States of America as a safe and efficient cathartic, "closely resembling the imported senna in its action, and capable of being substituted for it in all cases in which the latter is employed." Like our official senna it frequently produces griping, and its action should therefore be corrected by combination with some aromatic, or a saline cathartic. It is, however, less active than ordinary senna, and therefore to produce an equal effect, it requires to be given in doses at least one-third larger. It is usually administered in the form of an infusion, "which should be made in the proportion of six drachms to half a pint, of which one half may be given for a dose."

U. S. Disp., by W. & B., p. 237; Wood, Therap. and Pharmacology, vol. ii, p. 509; Stillé, Therap. and Mat. Med., vol. ii, p. 421; Eberle, Mat. Mat., p. 147; Martin, in Amer. Journ. of Pharm., vol. i, p. 22; Amer. Journ of Pharm., vol. xxvii, p. 301.

DESCRIPTION OF PLATE.

Drawn from a specimen grown in the Royal Gardens, Kew, the fruit added from a specimen collected in New Mexico by Fendler, in the British Museum.

1. Upper part of a plant in flower.
2. A flower with the petals removed.
3. Pods.

4–6. Seeds.

(5, 6 enlarged.)

N. Ord. Leguminosæ, *Cæsalpinieæ*.

Tribe *Cassieæ*.

Genus Cassia, *Linn.*

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89. Cassia obovata, *Colladon, Hist. Cass., p.* 92 (1816).

Syn.—C. Senna, *Lam.* C. obtusa, *W. & A.* C. obtusata, *Hayne.* Senna obtusa, *Roxb.* Senna obovata, *Batka.*

Figures.—Woodville, t. 159 (fruit); Nectoux, Voyage haute Egypte, t. 1, cop. in Hayne, ix, t. 42; Hayne, ix, t. 43 (*C. obtusata*); Nees, tt. 347 and ("*C. Senna*") 348; Colladon, Hist. Cass., t. 15, fig. A; Batka, Mon. Senna, t. 3, cop. in Berg & Sch., t. 96; Baillon, Hist. Pl., ii, fig. 97.

Description.—A semi-shrubby or herbaceous perennial (sometimes an annual). Stem about 2—3 feet high, erect, smooth, pale green, somewhat ziczac, with long spreading branches, terete or angular. Leaves alternate, spreading, stalked, abruptly pinnate, petiole without a gland, with small, persistent, linear-lanceolate, acute, rigid, spreading stipules, leaflets opposite, in 3—6 pairs, nearly sessile, broadly oblong-obovate, rounded but mucronulate at the apex, unequal at the base, entire, pale glaucous green, usually glabrous, about 1 inch long, the upper one often rather larger than the lower. Flowers rather large, stalked, arranged in few-flowered, rather lax, erect, curved, stalked, axillary racemes, at first about the length of the leaves, afterwards much exceeding them; bracts large, thin, ovate, acute, orange-coloured, falling before the flowers expand. Calyx very deeply divided into 5 almost distinct, nearly equal, imbricate, oblong, obtuse, membranous, veined sepals. Petals 5, imbricate in bud, nearly equal, widely spreading, rounded, with an acute claw, bright yellow, veined. Stamens 10, distinct, hypogynous, unequal, the 3 uppermost abortive, very small, with short barren anthers, the 7 lower fertile with short filaments; anthers of the fertile stamens large, linear oblong, varying in size, the two lowest much longer than the rest and curved upwards, all 2-celled, dehiscing by 2 round pores at the apex of the cells.

Ovary stalked, oblong, falcately curved upwards, about the length of the longest stamens, minutely downy, strongly compressed, with several ovules, style shorter than the ovary, curved, slender, stigma terminal. Pod about $1\frac{1}{2}$ inch long by $\frac{5}{8}$ broad, shortly stalked, flat, much compressed, rounded at each end, curved, oblong-reniform, smooth, slightly veined, tipped by the persistent style, 2-valved, the valves parchment-like, with a line of narrow prominent rounded crests along the centre, one over each seed. Seeds about 10, separated by projections inwards of the valves, on very long funicles, obovate-wedgeshaped in outline, compressed, hilum large at the pointed end, embryo large, straight, in the axis of scanty endosperm, cotyledons foliaceous, flat, oblong, radicle short.

Habitat.—This sort of Senna grows wild commonly in dry sandy ground throughout Egypt, Nubia, and Abyssinia. It is also found in Tripoli, and extends to Senegal and Benguella in West Tropical Africa. In Asia it is found in Arabia and India.

This was the first kind of Senna known, having been introduced by the Moors into Europe, and in the sixteenth century abundantly cultivated in North Italy; its cultivation has also been carried on in Spain and Southern France, but has long since been given up. The "Senna italica," as it was called by the old writers on plants, is described as an annual. It was long ago grown in gardens as a curiosity in England, and though it flowers with us, very rarely produces seed. In the West Indies it was a very early introduction, and has now in some of the islands acquired a native appearance.

C. obtusata, Hayne, is a slight variety with blunter leaves. Batka describes two other varieties, *pilosa* with pubescent leaflets, and *platycarpa* with the pods less curved.

*Senna,** made a genus separate from *Cassia* by Gaertner, Roxburgh, Batka and others, is characterised by its flat short pods, axillary racemes which greatly elongate after flowering, large caducous bracts, and the absence of glands on the rachis of the

* An Arabian name.

leaves. It corresponds to the series *Brachycarpæ* of Bentham's recent revision of the genus *Cassia*.

On the botanical history of the medicinal Sennas much has been written; the following being the principal treatises:—Nectoux, 'Voyage dans la haute Egypte' (1808), Colladon, 'Hist. Nat. et Méd. des Casses' (1816), Bischoff in 'Bot. Zeitung,' 1850, Batka, 'Monogr. der Cassien gruppe Senna' (1866).

Parkinson, Theatr. Bot., p. 225; Roxb., Fl. Ind., ii, p. 344; Wight & Arnott, Prod. Fl. India, i, p. 288; Bentham, in Trans. Linn. Soc., xxvii, p. 553; Batka, Monogr. Senna (1866), pp. 32, 46; Oliver, Fl. Trop. Africa, ii, p. 277; Lindl., Fl. Med., p. 259; Royle, Mat. Med., ed. 2, p. 404.

Official Part and Names.—Senna Alexandrina; the leaflets of Cassia lanceolata, *Lamarck, Encyc.*, and Cassia obovata, *Colladon* (B. P.). The dried leaves or leaflets of Cassia obovata, *Colladon*, and Cassia acutifolia, *Delile* (I. P.). Senna; the leaflets of Cassia acutifolia, *Delile*, of Cassia obovata, *De Candolle*, and of Cassia elongata, *Lemaire* (U. S. P.).

Kinds of Senna.—In English commerce three kinds of Senna are distinguished under the names of Alexandrian Senna, Bombay or East Indian Senna, and Tinnivelly Senna. Of these kinds Alexandrian Senna and Tinnivelly Senna are official in the British Pharmacopœia and the Pharmacopœia of India, under the two names of *Senna Alexandrina* and *Senna Indica*; and all three are official in the Pharmacopœia of the United States under the common name of *Senna*. Another kind of Senna is also official in the Pharmacopœia of the United States under the name of *Cassia Marilandica* or *American Senna*.

These several kinds are described by us as follows:—Alexandrian Senna under *Cassia acutifolia*, Del.; East Indian Senna and Tinnivelly Senna under *Cassia angustifolia*, Vahl; and American Senna under *Cassia marilandica*, Willd.

Senna from Cassia obovata.—The species of *Cassia* now under description is official in the British Pharmacopœia and the Pharmacopœia of India as one of the botanical sources of Alexandrian Senna, of which its leaflets formerly constituted a variable, although

by no means an inconsiderable, proportion. Thus Colladon gave the proportion in 1816 as three parts in ten, and Rouillure also states that it was customary to mix about three parts of this obovate Senna in every ten of Alexandrian Senna at the great entrepôt for this drug at Boulak, the port of Cairo. It was then collected in Upper Egypt and forwarded to Cairo; but at the present time, although the plant is still found at Karnak, Luxor, and many other parts bordering on the Nile, it is regarded as yielding a very inferior kind of senna, and which appears not to be collected in any regular manner. Hence, Alexandrian Senna now contains but few or none of its leaflets, as is noticed by us in our description of that drug; but the leaflets when present may be readily distinguished by their obovate outline. Obovate Senna is called by the Arabs *Senna baladi*, that is, *indigenous* or *wild senna*, to distinguish it from the leaflets of *Cassia acutifolia*, which are termed *Senna jebeli* or *mountain senna*.

Cassia obovata was formerly much cultivated for medicinal use in Italy, and its leaflets formed what was then termed *Italian Senna*. The kinds of Senna distinguished by Pereira and some other pharmacologists as *Tripoli Senna*, and *Senegal Senna*, also consisted of the leaflets of this plant; but these sorts are not now distinguished in commerce. This plant is also very common in some parts of Jamaica, where its cultivation has been suggested with the view of supplying the drug to the English and American markets. It is known in Jamaica under the name of Port-Royal Senna, or Jamaica Senna.

The *Composition*, *Adulterations*, and other details respecting this Senna are given under *Cassia acutifolia*; and its Medical Properties and Uses under *Cassia angustifolia*.

Gerarde's Herball, by Johnson (1636), p. 1297; Per. Mat. Med., vol. ii, pt. 2, pp. 351—356; Pharmacographia, p. 191; U. S. Disp., by W. & B., pp. 797 & 799; Woodville's Med. Bot., vol. iii, p. 447; Bentley, in Pharm. Journ., vol. vii, ser. 2, p. 448; Pharm. Journ., vol. ix, ser. 2, p. 143.

DESCRIPTION OF PLATE.

From a specimen in the British Museum collected in Egypt by Schweinfurth.

1. A flowering and fruiting branch.
2. Pistil with half the stamen removed.
3. A sepal.
4. A petal.
5. Pod with one valve removed.
6. Transverse section of pod.
7. A seed.
8. A leaflet.

(2–4, 7 enlarged.)

CASSIA ACUTIFOLIA Del.

M & N Hanhart imp.

N. Ord. LEGUMINOSÆ, *Cæsalpineæ*.
Tribe *Cassieæ*.
Genus Cassia, *Linn.*

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90. Cassia acutifolia, *Delile, Flore de l'Egypte,* ii, *p.* 219 (1812).

Alexandrian Senna. Nubian Senna.

Syn.—C. Senna, var. *β*, *Linn.* C. lanceolata, *Nectoux*, non *Forsk.* nec *W. & A.* C. lenitiva, *Bischoff.* C. officinalis, vars. B & C, *Royle.* C. æthiopica, *Guibourt.* Senna acutifolia, *Batka.*

Figures.—Nectoux, Voyage haute Egypte, t. 2, cop. in Hayne, ix, t. 41; Delile, Fl. de l'Egypte, ii, t. 27, cop. in Hayne, ix, t. 40; Steph. & Ch., t. 30 ("*C. Senna*"); Batka, Mon. Senna, t. 1, cop. in Berg & Sch., t. 8 f; Nees, t. 345 ("*C. lanceolata*"); Colladon, Hist. Cass., t. 15, fig. c.

Description.—A small shrub about two feet high. Stem much as in *C. obovata.* Leaves as in the last, but leaflets in 4 or 5 pairs, very shortly stalked, $\frac{3}{4}$ to $1\frac{1}{4}$ inch long, lanceolate or oval-lanceolate, acute at both ends and mucronate at the apex, entire, very finely pubescent or nearly smooth, rather thick, pale green. Flowers as in the last, but a little smaller, petals with a wider claw. Pod broadly oblong, about 2 inches long by $\frac{7}{8}$ broad, stalked, somewhat tapering below, almost straight, smooth or slightly puberulous, without any crests or other appendage; otherwise as in *C. obovata.* Seeds about 6 in the pod, structure as in the last species.

Habitat.—A native of tropical Africa, principally Nubia and especially the southern districts Sennaar and Kordofan; but it probably extends widely to the westwards, as it has been reported from Timbuctoo. It does not seem to occur in Arabia or India.

Delile's plate represents Batka's variety *Bischoffiana,* which possesses large leaves, pubescent on both surfaces, and rather larger and more pubescent legumes.

The name *C. lanceolata*, Nectoux, dates from 1808, and is therefore older than Delile's. The latter writer, however, quotes the name from an earlier work of his own, 'Mem. sur l'Egypte, tom. iii, p. 316, An. X' (=1802), which, however, we have not been able to see. Nectoux was under the mistaken notion that the plant was Forskål's *C. lanceolata*, which (as shown under no. 91) is quite different.

Oliver, Fl. Trop. Africa, ii, p. 278; Benth., in Trans. Linn. Soc., xxvii, p. 553; Batka, Monogr. Senna, pp. 27, 41; Lindl., Fl. Med., p. 259; Royle, Man. Mat. Med., ed. 2, p. 402; Flück. and Hanb., p. 190.

Official Part and Names.—Senna Alexandrina; the leaflets of Cassia lanceolata, *Lamarck, Encyc.*, and Cassia obovata, *Colladon* (B. P.). The dried leaves or leaflets of Cassia obovata, *Colladon*, and Cassia acutifolia, *Delile* (I. P.). Senna; the leaflets of Cassia acutifolia, *Delile*, of Cassia obovata, *De Cand.*, and of Cassia elongata, *Lemaire* (U. S. P.).

Kinds of Senna.—The kinds of senna ordinarily found in commerce, as well as those which are official, are generally alluded to under *Cassia obovata*, to which reference should be made. We now proceed to the particular description of the official Alexandrian Senna.

Alexandrian Senna.—At the present day, as noticed under *Cassia obovata*, this kind of senna consists essentially of the leaflets of *Cassia acutifolia*, the species now under description, with which we may find mixed in some specimens a few leaflets of *Cassia obovata*.

Collection and Commerce.—This senna is collected, at least so far as the present species is concerned, essentially in Nubia. Thus Ignatius Pallme, who travelled in the interior of Africa, says, "Senna is found in abundance in many parts of Kordofan, but the leaves are not collected on account of the existing monopoly. The Government draws its supply from Dongola in Nubia." According to Nectoux two crops are collected annually in Nubia, the first and more abundant being in September at the

termination of the rains ; and the other in April, the latter being in dry seasons a very bad one. The crops are gathered by the natives cutting down the plants, which are then exposed on the rocks in the burning sun till thoroughly dry, after which they are stripped, and the drug finally packed in bags made of palm leaves, and conveyed on camels to Essouan and Darao, and thence by the Nile to Cairo, from whence it reaches Alexandria. It is also said that this senna, which is termed *Senna jebeli* or *mountain senna*, sometimes reaches Cairo and Alexandria, by way of the ports of Massowah and Suakin on the western shore of the Red Sea. It is exported from Alexandria, from which port it derives its name, in large bales.

General Characters.—As formerly imported, Alexandrian Senna was commonly to be found in a very mixed and dirty condition. Thus, with the leaflets of senna a variable proportion of the leaf-stalks, flowers, broken twigs, and legumes of the senna plants might be found ; as also the leaves, flowers, and fruits of *Solenostemma Argel*, together with date-stones, dust, and various other extraneous matters ; and also, rarely, the leaflets and legumes of *Tephrosia Apollinea*. All these are directed in the British Pharmacopœia to be carefully removed from the senna leaflets, which then constitute what is properly termed *picked Alexandrian Senna*, and the characters of which are given as follows : — "Lanceolate or obovate leaflets, about an inch long, unequally oblique at the base, brittle, greyish green, of a faint peculiar odour, and mucilaginous sweetish taste. The unequally oblique base, and freedom from bitterness, distinguish the Senna from the Argel leaves, which, moreover, are thicker and stiffer." Of late years, however, the quality of Alexandrian Senna has very much improved, being in all cases free from any serious admixture of other leaves or any extraneous matters, and even in some specimens, the leaflets of *Cassia acutifolia*, in a well-preserved condition, have constituted its entire bulk. As already noticed, this kind of senna is now almost, if not entirely, composed of the leaflets of *Cassia acutifolia*, but we may occasionally find some leaflets of *Cassia obovata*. The leaflets of the two plants may be

doubtful by Dragendorff and Kubly. Another constituent of senna is a peculiar non-fermentable saccharine crystalline principle, termed *catharto-mannite.* Senna is also said by Ludwig to contain two bitter principles, *sennacrol,* soluble in ether, and *sennapicrin,* which is insoluble in that menstruum; it also contains several acids, salts, &c.

Medical Properties and Uses.—Similar to the other kinds of Senna; they are described under *Cassia angustifolia.*

Per. Mat. Med., vol. ii, pt. 2, p. 353; Per. Mat. Med., by B. and R., p. 856; Pharmacographia, p. 190; U. S. Disp., by W. and B., p. 798; Christison's Disp., 2nd ed., p. 850; Gmelin's Chemistry, vol. xviii (1871), p. 240; Bentley, in Pharm. Journ., vol. ii, ser. 2, p. 496; Journ. de Pharm., ser. 4, vol. v, p. 475; Groves, in Pharm. Journ., vol. x, ser. 2, pp. 196 and 364; T. & H. Smith, in Pharm. Journ., vol. x, ser. 2, p. 315; Siebold, in Pharm. Journ., vol. vi, ser. 3, pp. 445 and 456; C. L. Diehl, in Amer. Pract., December, 1875, p. 325, and Pharm. Journ., vol. vi, ser. 3, p. 744; Vierteljahrschr. (1873), no. 3, pp. 352—357; Proc. Amer. Pharm. Assoc., vol. xxiv (1876), p. 189.

DESCRIPTION OF PLATE.

Drawn from a specimen collected at Chartoum, Nubia, by Schweinfurth, in the British Museum.

1. A branch with flowers and fruit.
2. Stamens and pistil.
3. A petal.
4. One of the largest stamens.
5. A medium sized, and—6. One of the smallest stamens.
7. Pistil.
8. Fruit with one valve removed.
9. Transverse section of fruit.
10. A seed.
11, 12. Section of the same.
13. A leaflet.

(2–7, 10–12 enlarged.)

CASSIA ANGUSTIFOLIA, *Vahl.*

N. Ord. Leguminosæ, *Cæsalpinieæ.*

Tribe *Cassieæ.*

Genus Cassia, *Linn.*

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91. Cassia angustifolia, *Vahl, Symbolæ Bot.*, i, *p.* 29 (1790).

Arabian Senna. Tinnivelly Senna.

Syn.—C. medica, *Forskål* (name only) ex *Batka.* C. lanceolata, *W. & A.*, non *Forsk.*, nec *Nectoux.* C. elongata, *Lem.-Lisanc.* C. officinalis, var. A, *Royle.* C. medicinalis, *Bischoff.* Senna officinalis, *Roxb.* S. angustifolia, *Batka.*

Figures.—Nees, t. 346 ("*C. acutifolia*"); Batka, Mon. Senna, t. 2 (drawn from Forskål's specimen in the British Museum), cop. in Berg and Sch., t. 9 a; Royle, Illust. Himalayan Bot., t. 37 ("*C. lanceolata*").

Description.—A small shrub agreeing with *C. acutifolia* in the general characters of its stem and leaves. Leaflets in 5—8 pairs, 1 to nearly 2 inches long, narrowly lanceolate or obovate-lanceolate, slightly rounded at the base, somewhat tapering to the mucronate apex, entire, glabrous or very slightly pubescent beneath, bright green above, glaucous on the under surface. Flowers as in the last. Pod oblong, a little over 2 inches long, $\frac{5}{8}$ to $\frac{3}{4}$ inch broad, narrower than in *C. acutifolia,* in other respects similar. Seeds about 8 in the pod, otherwise as in the last.

Habitat.—This species was collected by Forskål during his travels in South-western tropical Arabia in 1763, and seems to be noticed in his "Fl. Ægypt.-Arab.," p. 85 ("Senna Meccæ *Lohajæ* inveniebatur"); according to Batka it is also the *Cassia medica* (p. cxi). Vahl described an authentic specimen, which is expressly stated to have borne no name, as *C. angustifolia,* but many subsequent authors have considered this to be the *C. lanceolata* of Forskål (*C. Forskålii,* Royle). This latter plant, also collected in Arabia, has, however, been figured from authentic specimens by Bischoff in the 'Bot. Zeitung' for 1850, t. 10, and is considered by Bentham to be merely *C. Sophera,* L., a common tropical species which has no connection with the Sennas of commerce.

Composition.—The composition of senna is given under *Cassia acutifolia.*

Medical Properties and Uses.—Senna is extensively employed as a brisk and safe purgative. The Alexandrian kind is usually regarded as the most active, then Tinnivelly, and lastly, Arabian Senna. There is, however, but little difference in the action of the two former, and both are ordered to be employed indifferently in the preparations of the British Pharmacopœia.

Senna is well adapted for children, elderly persons, and delicate females. The objections to its use are its nauseous taste, its tendency to gripe, and its somewhat irritant action in certain cases. The way in which its disgusting taste may be got rid of has already been referred to in speaking of the composition of Alexandrian Senna, under *Cassia acutifolia;* the griping may be prevented by suitably combining it with salines, and some aromatic, as in the common black draught, and also in the compound senna mixture of the British Pharmacopœia. Its occasional drastic property indicates that it should not be administered when the alimentary canal is much affected; but as a general rule, it may be given with safety in almost all cases where a purgative medicine is required.

Its active principle (cathartic acid) must pass out of the system in the secretions unaltered, for when senna is taken by nurses, the suckling infant becomes purged.

On the Continent the legumes of Senna are also employed as a purgative. By many they are preferred to the leaflets, as their action is said to be milder, and not to cause sickness or griping.

Per. Mat. Med., by B. & R., p. 859; Pharmacographia, p. 192; U. S. Disp., by W. & B., p. 800; Bentley, in Pharm. Journ., vol. xvii, ser. 1, p. 499, and vol. ii, ser. 2, p. 499; Holmes, in Pharm. Journ., vol. v, ser. 3, p. 623; Groves, in Pharm. Journ., vol. x, ser. 2, p. 202; Proc. Amer. Pharm. Assoc. (1874), vol. xxii, p. 152.

DESCRIPTION OF PLATE.

Drawn from an Indian specimen (Wight, no. 654) in the British Museum. 1. A flowering and fruiting branch. 2. Pistil with half the stamens removed. 3. A petal. 4. A pod with one valve removed. 5. A seed. 6. A leaflet. (2, 3, 5, enlarged.)

TAMARINDUS INDICA.

N. Ord. LEGUMINOSÆ *Cæsalpineæ*.

Tribe *Amherstieæ*.

Genus Tamarindus,* *Linn.* B. & H., Gen., i, p. 581; Baill., Hist. Pl., ii, p. 182. The only species is the following.

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92. Tamarindus indica, *Linn., Sp. Plant, ed.* 1, *p.* 34 (1753).

Tamarind. Tintiree (Bengal).

Syn.—T. occidentalis, *Gaertn.* T. officinalis, *Hook.*

Figures.—Woodville, t. 161; Hayne, x, t. 41; Steph. & Ch., t. 88; Nees, t. 343; Berg & Sch., t. 9 c; Bot. Mag., t. 4563; Baill., l. c., figs. 73–76; Beddome, Fl. Sylvat., t. 184.

Description.—A large tree, attaining 60 to 80 feet in height, and bearing a very large, widely-spreading head of foliage, trunk with a dark rough bark, youngest twigs smooth or slightly pubescent. Leaves alternate, with small, linear, very caducous stipules, abruptly pinnate, 3 or 4 inches long; leaflets in about 8—16 pairs, opposite, ½—1 inch long, sessile, articulated, set on obliquely and overlapping, oblong, usually very blunt, unequal at the base, entire, rather thick, veined beneath. Flowers rather small, stalked, readily disarticulating, arranged in lax, few-flowered racemes which are axillary or terminal on short lateral branches generally shorter than the leaves. Calyx narrowly funnel-shaped below, divided above into 4 ovate-lanceolate, acute, entire, spreading segments, imbricate in the bud, and then reddish-purple, the upper one the largest (made up of two combined). Petals 3, 1 posterior, 2 lateral, oblong or oval, the posterior one narrowest, about as long as the calyx segments, perigynous, somewhat crisped at the margin, white or pale yellow with red veins; two minute subulate bodies in front of the stamens may represent abortive anterior petals. Stamens with the filaments connate below to form a sheath, open above, and inserted perigynously on the anterior (inferior) part of the mouth of the calyx-tube, only 3

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* *Tamarindus*, a mediæval Latinization of the Arabic name for the fruit, meaning Indian Date.

perfect, on rather long free filaments alternating with other rudimentary ones at the summit of the sheath; anthers oblong, dehiscing longitudinally. Ovary on a stalk coming from the posterior (superior) part of the calyx-tube, curved upwards, 1-celled, with numerous ovules; style long, hooked. Fruit pendulous, pod-shaped, slightly compressed, scarcely an inch wide, varying in length from 3 to 6 inches, usually somewhat curved, nearly smooth, pale chocolate brown, pericarp (epicarp) rather thin, indehiscent, easily broken, filled with a firm soft pulp surrounding the seed-cavities; on the outer surface of the pulp run three tough, woody, branching fibrous cords, from the base towards the apex. Seeds 2 to 8 (according to the length of the fruit), each lodged in a cavity in the pulp lined with a tough membrane (endocarp ?), somewhat quadrangular with rounded angles, flattened, with the centre of each flat side marked with a large central depression, smooth, purplish-brown, somewhat polished; embryo with large thick cotyledons, which include the small radicle; no endosperm.

Habitat.—This beautiful and useful forest-tree is now found in all tropical countries, but Africa appears to have the greatest claims to be considered its original home. On that continent it is common in the districts of the Upper Nile, in Nubia and Abyssinia, the central districts wherever explored, and the more southern countries on both east and west coasts, Senegal and Zambesi-land. The tamarind grows also throughout the Indian Peninsula and in the Philippines and Java, and has been collected in tropical Australia and the Pacific Islands. In the New World it has doubtless been introduced, but is now abundant in Jamaica and other W. Indian Islands, Brazil, Central America, &c. It is extensively planted in warm countries, not only for its fruit, but for the scent of its blossoms, and as a shade-tree. Small specimens may be seen in our stoves (where they flower but do not produce fruit).

Roxburgh, Fl. Ind., iii, p. 215; Benth., Fl. Austral., ii, p. 294; Oliver, Fl. Trop. Africa, ii, p. 308; Lindl., Fl. Med., p. 266.

Official Part and Names.—TAMARINDUS; the preserved pulp of the fruit, imported from the West Indies (B. P.). The pulp of

the fruit (*Tamarindi Pulpa*) (I. P.). TAMARINDUS; the preserved fruit (U. S. P.).

Preservation of Tamarinds.—Before being exported, tamarinds always undergo some preparation, which varies, however, in different countries. Thus, the usual mode of preserving them in the West Indies is, to remove the shell or epicarp from the ripe fruit, and to place alternate layers of the shelled fruit and powdered sugar in a cask or jar, and then to pour boiling syrup over them till the cask or jar is full; or they are simply placed in layers in a cask, and boiling syrup poured over them. In the East Indies, it is the usual practice to prepare the fruits by simply removing their outer shell, and pressing the remaining portions together into a mass. The pulp of West Indian Tamarinds is alone official in the British Pharmacopœia, and in the Pharmacopœia of the United States; but on the Continent of Europe, the pulp of East Indian Tamarinds is only employed for medicinal purposes.

Kinds of Tamarinds.—In commerce the two kinds of tamarinds as thus preserved, the former with sugar, the latter without, are distinguished as West Indian and East Indian Tamarinds, the characters of which are as follows:

1. *West Indian Tamarinds.*—These, which are also called *Brown or Red Tamarinds*, are found in the form of a reddish-brown, moist, sugary mass, enclosing strong fibres, and brown shining seeds, each of which is enclosed in a membranous coat; they have a very agreeable, refreshing, sub-acid taste. This kind of tamarinds is said to be sometimes prepared in copper vessels, and to be therefore liable to contamination with that metal, to detect which a piece of bright iron should be left in contact with the pulp for an hour, when copper, if present, will be deposited on it. West Indian Tamarinds is the kind usually found in the shops in this country and the United States, and is, as already stated, the only official kind.

2. *East Indian Tamarinds.*—These are also termed *Black Tamarinds*, and are found in the form of a firm, clammy, brown or black mass, consisting of the pulp and seeds, mixed with strong fibres and some remains of the shell. They have a very acid taste.

Besides the two kinds of commercial tamarinds as above described, there is a third kind of tamarinds sometimes to be found in the south of Europe, and known as *Egyptian Tamarinds*. This kind is in the form of flattened rounded cakes, 1 or 2 inches thick and from 4 to 8 inches in diameter, of a firm consistence, and black colour. The cakes are prepared by kneading together the softer part of tamarinds; and are much used in Egypt and some other parts of Africa.

The principal constituents of unpreserved tamarind pulp are *sugar* and *pectin* with *citric, acetic,* and *tartaric acids,* either in a free state or combined with potash, the latter more especially in the form of the bitartrate. There is no known constituent in tamarinds to account for their laxative properties.

Medical Properties and Uses.—Tamarinds have slightly laxative properties, and are also refrigerant from the acids they contain. An infusion of tamarind pulp forms a very grateful and useful drink in febrile affections. Tamarind whey, which may be prepared by boiling about two ounces of the pulp with two pints of milk, may be similarly used. Tamarind pulp is occasionally prescribed in combination with other mild cathartics, as in the confection of senna. It is also sometimes useful, and forms a pleasant addition to the diet of convalescents, to maintain a slight action on the bowels.

In very hot countries, as in the interior of Africa, tamarinds are highly valued for the preparation of refreshing beverages.

The seeds contain tannic acid, and are therefore used in India as an astringent in bowel affections; and when deprived of their testa by long boiling, the soft kernels which are left, are eaten by the natives of India as food, in times of scarcity.

Per. Mat. Med., vol. ii, pt. 2, p. 348; Pharmacographia, p. 198; U. S. Disp., by W. & B., p. 856; Pharmacopœia of India, p. 445.

DESCRIPTION OF PLATE.

Drawn from a specimen in the Royal Botanic Society's Garden, Regent's Park, in flower in July; the fruit added. 1. A flowering branch. 2. Vertical section of flower. 3. The androecium. 4. A fruit. 5. Vertical section of part of the same. 6. Seed. 7 and 8. Sections of the same. (2, 3 enlarged.)

D Blair FLS ad nat. del. et lith.

COPAIFERA LANGSDORFFII, *Desf.*

M & N Hanhart imp.

N. Ord. LEGUMINOSÆ, Cæsalpineæ.

Tribe *Cynometreæ*.

Genus Copaifera,* *Linn.* B. & H., Gen., i, p. 585 (includes *Guibourtia*); Baill. Hist., ii, p. 192. There are about 14 species, natives of Tropical South America and of Tropical Africa.

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93. Copaifera Lansdorffii,† *Desf. in Mém. Mus. d'Hist. Nat.*, vii, *p.* 377 (1821).

Copaiba.

Syn.—C. nitida, *Hayne.* C. Sellowii, *Hayne.* C. laxa, *Hayne.* C. glabra, *Vogel.* C. Jussiæi, *Hayne ?.*

Figures.—Mém. du Muséum, vii, t. 14, cop. in Hayne, x, t. 19; Nees, Supp.; Berg & Sch., t. 6 f; Fl. Brasil., xv, t. 63, fig. 1; Hayne, x, t. 17 (*C. nitida*), t. 18 (*C. laxa*), and t. 22 (*C. Sellowii*).

Description.—Usually a small tree, or even a shrub, but sometimes reaching a height of 60 feet, much branched, bark brown, rather smooth, the young twigs pubescent. Leaves numerous, alternate, with filiform, early deciduous stipules, shortly stalked, abruptly pinnate, the rachis glabrous or faintly pubescent, leaflets opposite or sub-opposite in 3 to 5 pairs, very shortly stalked, without stipellæ, usually about $1\frac{1}{4}$ inch long, but varying from 1 to 2 inches, broadly oval, oval-oblong or ovate-oblong, obtuse but often somewhat attenuate at the apex, rounded and often unsymmetrical at the base, entire, quite glabrous, rather coriaceous, closely reticulated with veinlets, which are more visible above than below, pellucid-punctate. Flowers small, shortly stalked, laxly arranged in short spicate racemes, which are combined into sparingly branched axillary panicles slightly exceeding the leaves, bracts small, very caducous. Calyx divided nearly to the very base into 5 spreading, nearly equal,

* *Copaifera*, from *copaiba*, the native Brazilian name of the tree and its product.

† Dedicated to M. Lansdorff, the Russian Consul-General at Rio Janeiro, from whom Desfontaines received his specimens. It is often, but incorrectly, spelt *Langsdorffii*, and the plate is so lettered.

oblong-lanceolate, acute, thick segments, quite glabrous outside, densely covered with adpressed silvery hairs within, white or pinkish, valvate in the bud, the upper one rather the largest and somewhat hooded. Petals none. Stamens 10, hypogynous, distinct, spreading, filaments slender, much longer than the sepals, glabrous, anthers small, pale yellow, roundish. Ovary on a short thick stalk, ovoid, compressed, densely fringed with long rufous hairs, smooth on the sides, one-celled, with 2 ovules; style short, filiform, tapering, stigma small, capitate. Pod small, $\frac{3}{4}$ to 1 inch long, shortly stalked, obliquely oval-orbicular, apiculate, smooth, laterally compressed, orange-brown, dehiscent into two valves. Seed solitary, pendulous, the funicle dilating into a large, thin but fleshy, cup-shaped arillus which covers half the seed, testa smooth, dark brown, hilum small, cotyledons large, plane-convex, no endosperm.

Habitat.—The species of *Copaifera* above described is a native of a very wide area in Brazil, being found in the provinces of Ceara, Minas Geraes, S. Paulo, &c., where it grows in dry woods and open places, and is apparently common, flowering in December. It is very variable in habit, and also presents varieties in the size and amount of pubescence of the leaflets, upon which the species *C. glabra*, Vog., and *C. laxa*, Hayne, have been founded. The leaves are sometimes much smaller than in our plate.

The other species said to afford the oleo-resin are the following, but from the great similarity of the flowers and fruit their characters rest upon the foliage alone, and are consequently very ill-defined; and this in spite of the work bestowed upon them by Hayne in 1827, Bentham in 1870, and Baillon in 1877. Mr. Bentham, in the 'Flora Brasiliensis,' admits 11 species as native of that vast region.

C. officinalis, L. (*C. Jacquini*, Desf.), was the first species known, and is figured in Woodville, t. 216; Steph. and Ch., t. 158; Hayne, x, t. 14, and Nees, t. 340; also in Humb. Bonpland and Kunth's Nov. Gen. & Sp., t. 659. It is a native of Venezuela, Trinidad, and Central America, and is also cultivated in the West Indies and elsewhere, as well as in hot-

houses in this country, where it occasionally flowers. It does not grow in Brazil.

C. Martii, Hayne, is found in British Guiana and near the Amazons River in N. Brazil. It is figured in Hayne, x, t. 15, and Nees, Supp. Bentham now considers his *C. pubiflora* to be a variety of this, and Baillon thinks that this connects *C. Martii* with *C. officinalis.*

C. guianensis, Desf. (including *C. bijuga,* Hayne), grows throughout Guiana and in North Brazil. It is figured in the Mémoires du Muséum, vii, t. 13, cop. in Hayne, x, t. 13, and (*C. bijuga*) in Hayne, x, t. 16, and Nees, Supp.

C. coriacea, Mart. (*C. cordifolia,* Hayne), is illustrated in Hayne, x, tt. 20, 21, and Nees, Supp. It also is found in the northern provinces of Brazil.

C. rigida, Benth., a sylvan species of the same region, has not been figured.

It is doubtful whether *C. oblongifolia,* Mart., figured in Hayne, x, t. 33, yields any balsam.

With regard to *C. multijuga,* Hayne, which has been stated to be the source of the copaiba shipped at Para, it is a very doubtful member of the genus, according to both Bentham and Baillon. The authentic specimen consists merely of leaves, and these Professor Baillon is inclined to refer to *Dialium.* Seeds of the Para "Copaiba blanca" have been recently brought to Kew by Mr. Cross. It is said to be a gigantic tree, with a trunk which sometimes rises to a height of 80 feet before branching. There are now two young plants at Kew, which it is to be hoped will live to decide the systematic position of the species.

Desfontaines, in Mem. Mus. d'Hist. Nat., vii, p. 377; Hayne, in Linnæa, i (1826), p. 429; Bentham, in Fl. Brasil., xv, 242; Baillon, in Journ. de Pharm. & Chimie, 4, xxv, p. 251, translated in Pharm. Journ., April, 1877, p. 873; Lindl., Fl. Med., p. 278; Flück. & Hanb., Pharmacogr., p. 200.

Official Parts and Names.—COPAIBA; the oleo-resin obtained from incisions made in the trunk of Copaifera multijuga, *Hayne,* and other species of Copaifera (B. P.). An oleo-resin obtained

from the trunk of the tree by incision (I. P.). Copaiba; the oleo-resin of Copaifera multijuga, *Hayne*, and of other species of Copaifera (U. S. P.). Besides the oleo-resin, the volatile oil (*Oleum Copaibæ*) is also official. As may be seen, from our botanical description, the source of Copaiba is incorrectly given in the Pharmacopœias as Copaifera multijuga, for we have no authentic evidence of the characters of this plant, not even sufficient to prove that it belongs to the genus *Copaifera*.

Extraction, Collection, and Commerce.—Copaiba is obtained by making cavities into the very heart of the tree near the base, either by boring with a large auger, or more generally by cutting out a deep wedge from the trunk. It usually flows so abundantly from these cavities that, at the proper season, as much as twelve pounds have been collected in the space of three hours. If, however, none should flow, the wound is immediately closed with wax or clay, and reopened after about fourteen days, when an abundant discharge then generally takes place. It is said that old trees sometimes furnish copaiba two or three times in the year. As it first flows from the tree it is a very thin, clear, and colourless liquid; but it soon becomes thicker, and acquires a yellowish tinge.

Copaiba is contained, according to Karsten, in large resiniferous ducts, which are frequently more than an inch in diameter, and are to be found running through the whole stem. In some cases the oleo-resin collects in such quantities in these ducts that the pressure exerted is so great as sometimes even to burst the trunk of the tree; and the sound thus caused is said by Spence "to resemble the boom of a distant cannon, and is quite distinct from the crash of an old tree falling from decay, which one hears not unfrequently," in the vast solitudes of a South American forest.

Copaiba is chiefly collected in the valleys of the Amazon and its tributaries in Brazil, from whence it finds its way to Europe and the United States by way of Para and Maranham, stored in casks or barrels. It is also collected on the banks of the Orinoco and its affluents, from whence it is chiefly exported from Angustura,

but also to some extent by way of Trinidad. It is likewise largely collected in Venezuela, and is then exported chiefly from Maracaibo. Copaiba is also sometimes shipped from Rio Janeiro, Demerara, Carthagena, and some of the West India islands. It often reaches this country by way of Havre or New York.

General Characters and Varietics.—Copaiba, Copaiva, or Capivi, by all of which names it is known, is a more or less viscid liquid, varying in colour from a light yellow to a pale golden brown, with a peculiar, aromatic, not disagreeable odour, and a persistent, acrid, somewhat aromatic, and bitterish taste. Its specific gravity varies, according to the greater or less proportion of volatile oil it contains, from 0·940 to about 0·993. It is generally transparent and not fluorescent; but some varieties are always opalescent, and occasionally copaiba is slightly fluorescent. When freshly imported, the copaiba from Para is sometimes quite colourless, and as thin as water. By keeping copaiba always becomes denser, and acquires a deeper colour, a change which is partly due to the volatilization, and partly to the oxidation of its volatile oil. As shown by Buignet, copaiba varies in its action on polarised light, different samples not only varying in degree, but also in direction, some being dextrogyre, others levogyre. By the application of heat copaiba becomes more fluid, by which character it may be distinguished from Gurgun Balsam or Wood Oil, which, when heated in a closed glass tube to about 270°, becomes gelatinous, and on cooling does not resume its former fluidity. Copaiba is perfectly soluble in an equal volume of benzol; it is also soluble in absolute alcohol, acetone, and bisulphide of carbon. When gently heated with moistened magnesia, lime, or baryta, in certain proportions, which vary according to the amount of acid resin which the copaiba contains, it forms a more or less stiff compound.

Several varieties of copaiba have been distinguished in commerce, as Para, Maranham, Maracaibo, West Indian, &c. These vary much from one another in colour, consistence, odour, taste, degree of transparency, and in the proportion of volatile oil they contain. By these characters experienced judges will distinguish

the different kinds, but they can scarcely be accurately defined by pharmacologists.

Composition.—Copaiba is a solution of resin in volatile oil, and is, therefore, properly speaking, an oleo-resin like the fluid turpentines of the Coniferæ. It contains neither benzoic nor cinnamic acid, the presence of one or the other of which is necessary, in the opinion of most pharmacologists, to constitute a balsam; hence those who hold this view, consider that the term *Balsam of Copaiba* is improperly applied to it. *The volatile oil of Copaiva is official;* it is contained in different samples of copaiva according to their botanical source and age, in proportions varying from 40 to 60 per cent. One sample yielded as much as 80 per cent. when recently imported. It is readily obtained by subjecting copaiba to distillation with water. In composition and chemical characters it resembles oil of turpentine. It is colourless or pale yellow, with the odour and taste of copaiva; its specific gravity varies from 0·88 to 0·91. It varies in its optical powers, some specimens being dextrogyre, but more generally they are levogyre. It is readily soluble in ether, and in about eight parts of rectified spirit. It is regarded as the essential constituent of copaiva.

After copaiva has been deprived of its volatile oil by distillation, a brownish, amorphous, brittle resin, of an acid nature, is left behind. This is the ordinary resin of copaiba; it may be obtained in a crystalline condition, and is then known as *copaivic acid.* The resin itself only yields amorphous salts; but *copaivic acid* and the other resin acids which have been extracted from samples of copaiba, and which have been termed *oxycopaivic acid* and *metacopaivic acid,* form crystalline salts with bases.

Adulterations and Substitutions.—Copaiba is not unfrequently adulterated with castor oil or some other fixed oil, and also with oil of turpentine or other volatile oil. A consideration of the various means that have been described for detecting these and other adulterations does not come within our province; but for all details respecting them we must refer to special treatises on pharmacology and chemistry.

Two substances have also been especially described as useful substitutes for copaiva, namely, *Gurjun Balsam or Wood Oil*, derived from *Dipterocarpus turbinatus*, Gärtn. f., and other species of *Dipterocarpus*; and the oleo-resin of *Hardwickia pinnata*, Roxb., a large tree belonging to the Leguminosæ, and closely allied to *Copaifera* in its botanical characters. For a description of these we must also refer to special works on pharmacology.

Medical Properties and Uses.—In its action copaiva is a stimulant like the ordinary turpentines, but its influence is principally directed to the mucous membranes, and more especially to that of the genito-urinary organs. When administered by the stomach its odour can be detected both in the urine and breath, although it is said, that, only the resinous acid appears in the urine. In large doses it sometimes produces a specific eruption on the skin, which is often attended with much irritation. Nausea and vomiting, painful purgation, strangury and hæmaturia, are also in some cases the results of its action. As a remedy copaiva is of great value in certain affections of the bladder and urethra, as gonorrhœa, leucorrhœa, and cystitis; but in gonorrhœa and cystitis care must be taken not to administer it till after the acute inflammatory symptoms have subsided, or it may cause chordee and strangury. It is also a very useful remedy in chronic bronchitis, and other affections of the lungs and air passages attended with excessive secretion. It has likewise been found serviceable in some chronic skin diseases, as leprosy and psoriasis; and in diseased conditions of the mucous membrane of the rectum. The action of the volatile oil is the same as that of the oleo-resin, and may therefore be employed in similar cases. Copaiva is useful as a diuretic in some cases, more especially, according to Garrod, "in simple ascites from cirrhosis of the liver, without attendant albuminuria." Wilks has found the acid resin quite as efficacious in causing diuresis as the oleo-resin.

Per. Mat. Med., vol. ii, pt. 2, p. 366; Per. Mat. Med., by B. & R., p. 865; Pharmacographia, p. 202; U. S. Disp., by W. & B., pp, 332 & 1306; Garr. Mat. Med., p. 246; Karsten, Botanische Zeitung, 15 (1857), 316; Flückiger, in Wiggers and Husemann's Jahresbericht for 1867, 162, and for 1868, 140; Amer.

Journ. of Pharm., vol. xxii, p. 289; Pharm. Journ., vol. vii, ser. iii, pp. 516, 873, 533, 745, 786, & 808; Year Book of Pharmacy for 1876, p. 197; Proc. Amer. Pharm. Assoc., vol. xxv, pp. 214—217.

DESCRIPTION OF PLATE.

Drawn from specimens in the British Museum, collected in Ceara and Minas Geraes, Brazil, by Gardner (no. 1929) and Claussen.

1. A small branch with flowers.
2, 3. Flowers.
4. Vertical section of pistil.
5. Fruit.
6. The same with one valve removed.
7, 8. Seeds.
9. Vertical—and 10. Transverse section of the same.
11. A leaflet.

(2-4 enlarged.)

M & N Hanhart lith.

ACACIA SENEGAL, *Willd*

N. Ord. LEGUMINOSÆ, *Mimoscæ*.

Tribe *Acacieæ*.

Genus **Acacia**,* *Willdenow*. B. & H., Gen., i, p. 594; Baill., Hist. Pl. ii, p. 68. Schweinfurth, in Linnæa, xxv (1867), pp. 308—376. Over 430 species are known, found principally in Australia, but also in the hotter parts of America, Africa, and Asia.

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94. Acacia Senegal,† *Willd., Sp. Plant.*, iv, *p.* 1077 (1805).

Verek (Senegal). *Hashab* (E. Africa).

Syn.—Mimosa Senegal, *Linn.* M. senegalensis, *Lam.* Acacia Verek, *Guill. & Perr.* A. rupestris, *Stocks.*

Figures.—Guill. & Perr., Fl. Senegamb., i, t. 56; Schweinfurth, in Linnæa, xxv, t. 22 A (fruit); Reliquiæ Kotschyanæ, t. 3 (leaves and fruit).

Description.—A small tree, about 20 feet in height, with an erect trunk and irregular, tortuous, slender, terete branches, the young ones somewhat thickened at the nodes where are three strong hooked prickles, one beneath the petiole and two lateral (sometimes straight), infra-stipular in position, all dilated at the base, polished and black above; bark nearly smooth, brown, on the young branches pale greyish brown, or nearly white. Leaves alternate, often in axillary fascicles of two, rather small, 1—1½ inch long, shortly stalked, without apparent stipules, bipinnate, the rachis slender, finely tomentose, with a small gland at the apex and another near the base, primary divisions (pinnæ) opposite in 3 to 5 pairs about ½ inch long, leaflets opposite in 10 to 20 pairs, crowded, sessile, linear-oblong, obtuse or acute, rigid, easily disarticulating from the rachis, greyish green, about ⅛ inch long. Flowers sessile, small, laxly arranged in slender, cylindrical, erect, stalked spikes 2—3 inches long, from the axils of the leaves, and much exceeding them. Calyx campanulate, cut

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* *Acacia*, *ἀκακία*, was the name given to a thorny Egyptian shrub by Dioscorides.

† *Senegal*, the name of the country where the plant was first found.

about half way down into 5 narrow-triangular acute segments, downy. Corolla usually gamopetalous, campanulate, about twice the length of the calyx, divided nearly half way down into 5 acute segments, white. Stamens very numerous, filaments slender, erect, about 3 times the length of the corolla, yellowish, united at the very base into a very short perigynous tube inserted on the base of the corolla, anthers very small, roundish. Ovary shortly stalked, very small, oblong, style terminal, filiform, shorter than the stamens, stigma terminal. Pod shortly stalked, 3 or 4 inches long by about $\frac{3}{4}$ wide, more or less constricted between the 2—6 seeds, flat except over the seeds, smooth, pale, membranous, with a strong fibrous marginal rib and fainter transverse reticulating veins. Seeds with a long funicle slightly dilated at the hilum, roundish in outline, very much compressed, marked on the centre with a concave arched line, brown, embryo with large circular plane-convex cotyledons and a small, blunt, slightly exserted radicle, no endosperm.

Habitat.—This species of *Acacia*, as indicated by its name, is a native of Senegal in West Tropical Africa, where it covers extensive tracts of sandy ground; it is also found abundantly on the other side of the continent in the countries bordering the Upper Nile, Southern Nubia, Atbara, and especially Kordofan, all in the tropics. The same species appears to occur in Scinde; whether it grows also in Arabia is not known.

From the explorations of the African traveller, Schweinfurth, there is no doubt that it is from this species that the best "gum arabic" is obtained in Nile-land. The gum exudes spontaneously from the branches and is readily detached; it is brought down the river into Egypt, from which country it is exported.

In Senegal, also, the gum of this plant has long been collected, but Adanson in 1788 was the first to properly describe the tree from which it is obtained. At the present time it is collected exclusively by the Moors in woods mainly composed of the tree on the right bank of the river Senegal, opposite the French ports of Dagana, Podor, Matam, &c. It is found to exude principally

during the prevalence of the dry desert winds from the north and east which blow in the winter after the rainy season. M. C. Martins has observed that the gum is excreted mostly at the bifurcation of the branches, but that its production is especially stimulated by the growth of a species of the parasitic genus *Loranthus*, which he has described as *Loranthus senegalensis*. This forms a large swollen base where it is inserted on the *Acacia*-branch, and around this the excretion of gum is very abundant.

The following African species of *Acacia* also afford inferior gum. They all differ from the above in having the flowers arranged in globose capitula.

Acacia tortilis, Hayne. Hayne, x, t. 31; Nees, t. 335.
A. arabica, Willd. (A. nilotica, *Desf.* A. vera, *Willd.*). Roxb., Pl. Coromand., ii, t. 149, cop. in Hayne, x, t. 32; Nees, t. 333. Cultivated also in India.
A. horrida, Willd. (A. capensis, *Burch.* A. Karroo, *Hayne*). Hayne, x, t. 33.
A. gummifera, Willd. Hayne, x, t. 28.
A. Seyal, Del. (A. Fistula, *Schweinf.*). Hayne, x, t. 30; Nees, t. 336; Schweinf., l. c., tt. 11–14; Berg & Sch., t. 6 d.
A. Ehrenbergiana, Hayne. Hayne, x, t. 29; Nees, t. 334.
A. stenocarpa, Hochst. Schweinf., l. c., tt. 17, 18.

Lamarck, Dict., i, p. 19; Guill. & Perrottet, Fl. Seneg. Tent., i, p. 245; Schweinfurth, in Linnæa, xxxv (1867), p. 374, and Reliquiæ Kotschyanæ, p. 3; Oliver, Fl. Trop. Africa, ii, p. 342; Benth., in Trans. Linn. Soc., xxx, p. 516; Flück. & Hanb., Pharmacogr., p. 206; C. Martins, in Bull. Bot. Soc. France, 1875, p. 20.

Official Part and Names.—Acaciæ Gummi; a gummy exudation from the stems of one or more undetermined species of Acacia, *Linn.* (B. P.). The gummy exudation from the stem of Acacia vera, *Willd.*, and other undetermined species of Acacia yielding Gum Arabic (I. P.). Acacia; a gummy exudation from Acacia vera and other species of Acacia (U. S. P.).

Production, Collection, and Commerce.—Acacia gum is not a *degradation-product* like that of Tragacanth gum, which owes its formation to the more or less complete transformation of the

cells of the pith and medullary rays of species of *Astragalus;* but it is a natural liquid product which at certain seasons is formed in such large quantities that it bursts through the tissues of the stem and branches, and subsequently hardens by exposure to the air. As a general rule, therefore, gum acacia exudes spontaneously, and so freely, that wounding the bark is unnecessary; but in some districts the outflow is facilitated by incisions. In Kordofan the gum is collected by breaking the lumps off the trees with an axe, and then placing them in baskets for convenience of transport. The best gum comes from Kordofan; it is known as *Hashabi* gum. It is said that 30,000 cwt. are collected annually in this district. In Senegal the gum begins to exude after the rainy season in November, at which period the dry winds from the desert set in and cause the bark to crack, when the juice flows out and hardens in large masses. The collection then commences and is continued more or less till the end of July. This gum is mostly shipped to Bordeaux, where in some years over 100,000 cwt. are imported. By far the greater proportion of the gum imported into this country arrives from Egypt, but the total amount is liable to great variation; thus, while according to Flückiger and Hanbury, we imported 76,136 cwt. in 1871, in 1872 our total importation was only 42,837 cwt.

Varieties and General Characters.—According to Flückiger and Hanbury the principal varieties of Acacia gum which are known in the London market are as follows: — 1. Kordofan Gum, Picked Turkey Gum, or White Sennaar Gum; 2. Senegal Gum; 3. Suakin Gum, Talca or Talha Gum; 4. Morocco, Mogador, or Brown Barbary Gum; 5. Cape Gum; 6. East India Gum; and 7. Australian or Wattle Gum.

1. *Kordofan, Picked Turkey,* or *White Sennaar Gum.*—The botanical source of this gum, according to the most reliable information, is *Acacia Senegal,* the plant now under description. It is termed in Egypt *Hashabi gum.* The common name of *Gum Arabic* which is applied to this and other kinds of gum derived from the species of Acacia is a misnomer, as very little

gum is collected in, and none appears to be exported from, Arabia.

This gum, which is the best of all the kinds and the only one that should be used for medicinal purposes, either occurs in spherical or ovoid tears or masses, which vary in size from that of a pea to a walnut; or in fragments of tears. When entire the tears are usually rounded on their surface, and more or less opaque in appearance from the presence of numerous cracks extending into their substance; but when in fragments, the pieces are angular, and have a glistening character. The presence of these cracks makes the gum very brittle, so that it is readily broken into small fragments; the fractured surfaces presenting a vitreous appearance. The finest pieces are colourless or nearly so, and without odour, but with a bland mucilaginous taste. When of inferior quality this gum has a brownish, yellowish-brown, or reddish-brown colour.

2. *Senegal Gum.*—This kind of gum, like that of Kordofan gum, is the produce of *Acacia Senegal.* But little of it comes to England, although, as already stated, it is largely imported into France from Senegal. It usually occurs in larger pieces than those of Turkey gum, being sometimes as large as a hen's egg or even a man's fist; and although we occasionally find pieces of a whitish colour, they are for the most part yellow, reddish-yellow, or brownish-red. The masses are also less brittle than the pieces of Kordofan gum, as the numerous cracks seen in the latter are nearly absent in Senegal gum; their fracture is also more conchoidal, and we frequently find large air cavities in their centre.

3. *Suakin Gum, Talca* or *Talha Gum.*—This gum, according to Flückiger and Hanbury, is yielded by *Acacia stenocarpa,* Hochst, and *A. Seyal,* Delile, var. *Fistula.* It is a very brittle gum, and hence although entire pieces are sometimes to be met with which are permeated in all directions by minute cracks, it is commonly seen in the market broken up into small fragments of a whitish, brownish, or reddish-brown colour. It is a very inferior variety of gum.

4. *Morocco, Mogador,* or *Brown Barbary Gum.*—The botanical source of this gum is supposed to be *Acacia arabica,* Willd. It is usually of a brownish colour, and is found either in small, angular, mostly broken pieces; or in tears, which when perfectly dry are permeated by cracks like Turkey gum, and very brittle.

5. *Cape Gum.*—This is principally derived from *Acacia horrida,* Willd. It is in small fragments of an amber-brown colour, and is regarded as a very inferior kind of gum.

6. *East India Gum.*—This gum is the produce of *Acacia arabica,* Willd., and other species of *Acacia.* It is principally imported from Bombay, hence its name; but it is almost entirely the produce of Eastern Africa. It varies very much in its appearance, and is commonly mixed with other gums; it is regarded as a very inferior kind.

7. *Australian* or *Wattle Gum.*—This is the produce of various species of *Acacia,* thus, according to Flückiger and Hanbury, of *A. pycnantha,* Benth.; *A. decurrens,* Willd.; *A. dealbata,* Link.; and *A. homalophylla,* A. Cunn. It is found commonly in large tears or masses, of a dark yellow or reddish-brown colour. This gum, which has a transparent appearance, being nearly free from cracks or fissures, is said to be readily soluble in water, and to form a very adhesive mucilage. It is frequently contaminated with pieces of the astringent barks of the trees from which it is obtained; hence its solution unless carefully prepared, will frequently contain some tannic acid.

It will be seen from the above general notice of the varieties of gum that they vary much in their characters, and that the Kordofan or Turkey Gum is the finest kind. The characters and tests of good gum are given in the British Pharmacopœia as follows:—"In spheroidal tears usually from half an inch to an inch in length, nearly colourless, and opaque from numerous minute cracks, or in fragments with shining surfaces; brittle; bland and mucilaginous in taste; insoluble in alcohol, but soluble in water. The aqueous solution forms with subacetate of lead an opaque white jelly. If an aqueous solution of iodine be added to

the powder, or to a solution formed with boiling water and cooled, there is no appearance of a violet or blue colour."

Composition.—Gum acacia consists essentially of an acid called *arabic acid, gummic acid,* or *arabin,* in combination with lime, magnesia, and potash. This salt or mixture of salts forms about 70 per cent. of the gum; the remainder consists of water, and of various saline and earthy matters. Gum acacia is soluble in both hot and cold water, and its solution has an acid reaction. Sub-acetate of lead, as already noticed, forms an opaque white jelly when added to the solution; but no precipitate is formed in a solution of gum acacia by the neutral acetate of lead, in which respect it differs from a solution of gum tragacanth, which yields an abundant precipitate under the same circumstances. By the action of nitric acid acacia gum is resolved into mucic acid and a little oxalic acid; and when boiled with diluted sulphuric acid it is slowly converted into grape sugar.

Medical Properties and Uses.—Gum acacia possesses demulcent and emollient properties, for which purposes it is sometimes employed medicinally; but it is chiefly used as a vehicle for the exhibition of other medicines, thus, to suspend insoluble powders, and in the formation of lozenges. In coughs gum often affords much relief, when it is allowed to dissolve slowly in the mouth; and under the same circumstances it is frequently useful in allaying irritation of the throat and air passages, by diluting the acid secretions and sheathing the parts from the action of the air. It is also used internally in inflammatory affections of the stomach and bowels; and its influence as a demulcent is supposed to extend even to the urinary organs, and thus to be useful in irritation of the bladder and urethra. But in the latter cases it is probable that its beneficial effects are in a great measure due to the quantity of fluid which is taken with it, diluting and thus diminishing the irritating action of the urine. Gum has also been recommended as a substitute for amylaceous food in diabetes, as it is not converted into sugar; but its use in this disease does not appear to have been attended with any appreciable benefit.

A thick mucilage of gum has also been recommended as an

application to burns and scalds, and to sore nipples, &c. The local application of powdered gum has likewise been found useful in checking hæmorrhage from leech-bites; and when blown up the nostril it has arrested severe epistaxis.

Gum also appears to possess some nutritive properties, as it forms almost exclusively the food of those engaged during the period of its collection, &c.; and also in times of scarcity of the Hottentots.

Gum is also largely used for other purposes than in medicine. Thus large quantities are employed in the arts for giving lustre to crape and silk; for thickening colours and mordants in calico printing, &c.; for suspending the tannate of iron in the manufacture of ink and blacking; and for other purposes. The bark and unripe fruits of several species of Acacia are also used for tanning and dyeing.

Steph. & Church., Med. Bot., by Burnett, vol. ii, pl. 77; Per. Mat. Med., vol. ii, pt. 2, p. 332; Per. Mat. Med., by B. & R., p. 848; Pharmacographia, p. 206; U. S. Disp., by W. & B., p. 6; Garr., Mat. Med., p. 247; Watts' Dict. Chem., vol. ii, p. 953; Schweinfurth, in Linnæa (1867), p. 308; Brandis, Forest Flora of North-Western and Central India, p. 181; Vaughan, in Pharm. Journ., vol. xii, 1st ser., p. 226; Fremy, in Ph. Jl., vol. i, 2nd ser., p. 518.

DESCRIPTION OF PLATE.

Drawn from a specimen collected in Senegal by Perrottet, in the British Museum; the fruit added from Schweinfurth.

1. A branch with flowers.
2. A flower.
3. Section of flower.
4. A pod.
5. The same, opened.
6, 7. Seeds.

(2 and 3 enlarged.)

D. Blanchard del. et lith.

M & N Hanhart imp

ACACIA CATECHU, *Willd.*

N. Ord. LEGUMINOSÆ, *Mimoseæ*.

Tribe *Acacieæ*.

Genus **Acacia**, *Willd.*

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95. Acacia Catechu,* *Willd., Sp. Plant.*, iv, *p.* 1079 (1805).

Khair, Kher (India).

Syn.—Mimosa Catechu, *Linn. f.* M. Sundra *and* M. catechuoides, *Roxb.* Acacia Chundra, *Willd.* A. Sundra, *Spreng.* A. Sandra, *Beddome.* A. catechuoides, *Benth.*

Figures.—Woodville, t. 157 (poor); Steph. & Ch., t. 76; Nees, t. 337; Berg & Sch., t. 6 e; Roxburgh, Pl. Coromandel, ii, t. 175, and (*A. Sundra*) ii, t. 225; Beddome, Fl. Sylvatica, t. 50 (*A. Sandra*).

Description.—A moderate-sized tree, not reaching more than 30 to 40 feet high and often smaller, with a short, somewhat crooked trunk, and numerous irregular straggling branches; bark brown or dark grey, rough, red and fibrous within; young branches smooth or pubescent, with a pair of sharp, hooked, brown prickles, just below the position of the stipules of each leaf. Leaves numerous, alternate, stalked; petiole with a prominent gland on the upper surface about the middle, and often armed with a few prickles, bipinnate, 5—8 inches long; pinnæ in 10—20 pairs, 1—2 inches long, narrow; leaflets opposite, 20—30 pairs in each pinna, sessile, overlapping, linear, blunt, $\frac{1}{8}$—$\frac{1}{4}$ inch long, glabrous or pubescent, entire. Inflorescence much as in *A. Senegal*, but the spikes often in pairs from the axils and the flowers a little larger, and pale yellow. Calyx glabrous or downy; corolla-segments rather broader; stamens about twice as long as corolla, the filaments not combined into a tube at the base; a small disk surrounds the stalk of the ovary; otherwise all as in *A. Senegal*. Pod 2—5 inches long by about $\frac{3}{4}$ inch broad, acute, containing 3—10 seeds, brown and shining, much flattened, smooth, coriaceous, with faint transverse anastomosing veins. Seeds as in the last species.

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* *Catechu* and *Kát* are Indian names for the extract, Kutch.

Habitat.—This is a common tree in most parts of India and Burmah, ascending to 3000 feet in the Himalaya valleys, generally growing gregariously. It is also found in Ceylon, but is probably not known out of Asia. It flowers in May and June. There are two forms in India, the glabrous (*A. Sundra*) and the pubescent (*A. catechuoides*); they are otherwise quite similar. The prickles are sometimes developed into hooked thorns of considerable length.

Catechu is also manufactured from *A. Suma*, Kurz, a very closely allied species, differing only in its white bark, more numerous leaflets, and shorter corolla. This is the *A. Catechu* of most authors, including formerly Bentham, whose more recent views are here followed. It is figured under that name in Beddome's 'Fl. Sylvatica,' t. 49, and as *A. campylacantha*, Hochst., by Schweinfurth in 'Plantæ Niloticæ,' t. 1. It is the commonest species in Southern India, but is scarcely known in the north of that country. It is this tree, and not the true *A. Catechu*, which is so widely spread in the forests of Eastern Tropical Africa, Sennaar, Abyssinia, Zambesi land, and Mozambique. No extract is, however, prepared from it on that continent. It has been also planted in S. America. The spines are sometimes very strong in this species.

Roxb., Fl. Ind., ii, pp. 562-3; Brandis, Forest Flora, p. 186; Oliver, Fl. Trop. Africa, ii, p. 344; Benth., in Trans. Linn. Soc., xxx, p. 519; Lindl., Fl. Med., p. 268; Flück. & Hanb., Pharmacogr., p. 213.

Official Part and Names.—Catechu Nigrum; an extract of the heart-wood (I. P.). Catechu; an extract prepared principally from the wood of Acacia Catechu (U. S. P.). It is not now official in our Pharmacopœia: but it was recognised in the first edition of the British Pharmacopœia published in 1864; and was formerly official in the London, Edinburgh, and Dublin Pharmacopœias.

Kinds of Catechu—We have noticed under the head of *Uncaria Gambier* the more important kinds of catechu which are known in

commerce, and described in detail the official *Catechu Pallidum* of the British Pharmacopœia and the Pharmacopœia of India. The official botanical source of the Catechu now to be described is *Acacia Catechu*, Willd., but it is also in part derived from *Acacia Suma*, Kurz.

Preparation.—The preparation of catechu varies somewhat in different localities; but as a general rule it may be thus described:—The trees are regarded as suitable for the process when about one foot in diameter, at which period they are therefore cut down, and then the inner dark-coloured wood is either alone cut into small chips, or, according to other accounts, the whole of the wood except that of the smaller branches, after being stripped of the bark, is thus treated. The chips are then put into small earthen pots or jars, which are arranged over a fireplace built of mud placed usually in the open air; and the whole covered with water. The water is then made to boil, and after a considerable portion has evaporated, the liquor is strained or simply decanted into another vessel, and the evaporation continued until the extract is of sufficient consistence, when it is poured into moulds made of clay, or of leaves pinned together; or simply upon a mat or cloth which has previously been covered with the ashes of cow-dung, and divided while yet soft into more or less square pieces by means of string. The drying is then completed in all cases by subsequent exposure of the extract to sun and air. In this way is prepared the ordinary dark-coloured varieties of catechu which are commonly found in Europe and America; but at Kumaon, in the north of India, by a modification of this process, the drug is obtained of a pale ashy-white or pinkish-brown colour. It is said that the essential difference in the preparation of this kind of catechu consists in stopping the evaporation before the decoction has arrived at the condition of an extract, and allowing the liquor to cool on twigs and leaves placed in the pots for that purpose.

Commerce.—A very large proportion of the Catechu now imported from British India into this country and the United States of America is the produce of Bengal and Burma. The

average total imports from British India into the United Kingdom for the years 1871, 1872, 1873, and 1874, was about 5000 tons, and the value in each year about £120,000. The best catechu comes from Pegu. It is imported into the United States either directly from British India, and chiefly from Calcutta, or indirectly from Great Britain. It is packed in mats, bags, or boxes.

General Description and Composition.—This kind of catechu, which is commonly known under the name of *Kutch* or *Cutch*, is generally distinguished from the official *Catechu pallidum* by its blackish colour; hence the name of *Catechu nigrum* by which it is also known. Several varieties of this catechu have been distinguished by pharmacologists from their varying forms and colours, &c., but it is generally found in large masses each of which weighs several pounds, and even in some cases as much as a hundredweight; these masses are made up of layers composed of more or less oblong pieces of catechu, which vary in length from six to ten inches, in breadth and depth from one to two inches or more, and each piece commonly enveloped in the large rough leaf of *Dipterocarpus tuberculatus*, Roxb. Cutch has a dark rusty-brown or blackish-brown colour externally; it is hard and brittle, and when broken, it presents a more or less shining bubbly surface of a blackish-brown colour or various shades of reddish brown. It dissolves slowly in the mouth, and has a very astringent and slightly bitter taste, succeeded by a sensation of sweetness; it has no odour. When recently imported it is sometimes soft and tenacious internally, and if it be then pulled out into a thin film it commonly presents a translucent granular appearance, and a bright orange-brown colour; or if examined under the microscope after being further softened in water, it exhibits in the same manner as gambier or pale catechu an abundance of very small acicular crystals of *Catechin* or *Catechuic acid*.

The ordinary cutch of commerce is essentially composed of *catechin* or *catechuic acid*, and *catechu-tannic* or *mimotannic acid*; but the pale-coloured cutch described above as being prepared at Kumaon, in Northern India, is almost entirely composed of the former. These two constituents may be readily distinguished by immers-

ing cutch in cold water, when the catechu-tannic acid is dissolved, forming a deep brown-coloured solution; and the catechin which is nearly insoluble in cold water is left behind as a mass of minute acicular colourless crystals. Catechin is, however, soluble in boiling water, and also in alcohol, and ether. Catechu-tannic acid is distinguished from gallo-tannic acid by its solution yielding a greenish precipitate with the persalts of iron; and by not causing a precipitate in a solution of emetic tartar. A minute quantity of *quercetin*, a yellow crystalline substance, may be extracted from a cold aqueous solution of cutch by means of ether, as first ascertained by Löwe.

Medical Properties and Uses.—The properties and uses of this kind of catechu are the same as those of pale catechu; they are described under *Uncaria Gambier*.

Per. Mat. Med., vol. ii, pt. 2, p. 340; Pharmacographia, p. 213; U. S. Disp., by W. & B., p. 240; Royle's Illustrations, p. 182; Woodville's Med. Bot., vol. ii, pl. 66, p. 183; Steph. & Church., Med. Bot., by Burnett, vol. ii, pl. 76; Madden, in Journ. Asiat. Soc. of Bengal, vol. xvii, pt. 1 (1848), p. 565; Watts' Dict. Chem., vol. i, p. 816; Gmelin's Chem., vol. xv (1862), p. 515; Fresenius, Zeitschrift für Anal. Chemie (1873), p. 127.

DESCRIPTION OF PLATE.

Drawn from a specimen in the British Museum, collected in India by Dr. Roxburgh.

1. A branch with flowers.
2. A flower.
3. Section of a flower.
4. A pod.
5. A seed.

(2, 3 enlarged.)

D.Blair F.L.S. ad sicc. del et lith.

PRUNUS DOMESTICA, *Linn.*

M & N Hanhart imp

N. Ord. Rosaceæ. Le Maout & Dec., p. 374; Baill., Hist. Pl., vol. i.

Tribe *Pruneæ* (= *Drupaceæ*). Lindl., Veg. K., p. 557 (N. Ord.).

Genus Prunus,* *Linn.* B. & H., Gen., i, p. 609; Baill., Hist. Pl., i, p. 478 (includes *Amygdalus*, *Cerasus*, &c.). Species about 80, natives chiefly of the temperate parts of the northern hemisphere.

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96. Prunus domestica,† *Linn., Sp. Plant., ed.* 1, *p.* 475 (1753).
Var. Juliana, *DC.*

French Plum. St. Julien Plum. Prune.

Figures.—Nouveau Duhamel, v, t. 54, fig. 2, and t. 56, fig. 9.

Description.—A small tree, reaching a height of about 15—20 feet, but usually smaller, with numerous spreading, nearly straight branches, without spines, forming a pyramidal or rounded head, young branches smooth. Leaves small, alternate, on longish petioles, provided with linear, fimbriated, pubescent stipules which are quickly caducous, blade about 2 inches long, oval, acute at both ends, crenate-dentate, smooth above, more or less pubescent beneath, convolute in the bud. Flowers appearing before the leaves, on rather long, slender, straight, pubescent pedicels, usually in pairs from lateral buds on the ends of last year's wood, about ¾ inch in diameter, numerous. Calyx with a deeply cup-shaped tube, and 5 oblong, obtuse, concave, spreading or recurved segments. Petals 5, roundish, with a very small claw, inserted on the rim of the calyx-tube, spreading, pure white, imbricate in the bud, soon falling. Stamens 20 or more, inserted perigynously on the mouth of the calyx-tube within the petals, filaments slender, stiff, about as long as the petals, anthers small, short, 2-celled, yellow. Ovary small, sessile at the base of the calyx-tube, tapering into the simple style, 1-celled, with 2 pendulous ovules, stigma truncate. Fruit a drupe, about 1—1½ inch in length, ovoid, smooth and rounded on all sides, skin thin, tough, dark purple, with a whitish

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* *Prunus*, the classical Latin name; in Greek, προῦμνος.

"bloom," pulp firm, greenish, juicy, stone (endocarp) readily separated from the pulp, rather small, broadly ovoid, rather laterally compressed and with a sharp edge, pointed at both ends, smooth on the surface, very hard. Seed solitary, filling the stone, ovoid, compressed, suspended, with a thin testa, radicle straight, no endosperm.

Habitat.—The particular variety of the plum, *Juliana*, here described is, according to Hanbury, largely cultivated in the Valley of the Loire in France, especially about Bourgueil, a small town lying between Tours and Angers. It is by no means one of the finest of the innumerable varieties of this generally cultivated fruit.

These are all probably derived from the wild plant known as *P. insititia*, originally a native of the mountains of Western Asia. As a garden fruit it appears to have been introduced into Europe by the Romans, and Pliny mentions a great number of varieties in his time. Amongst others he alludes to the *Damascena* (whence English damson), which, as its name indicates, was brought from Damascus, and is thought to be the κοκκυμηλέα of the Greeks.

The German Prune is from the variety called *P. œconomica*, Bork., which is largely grown in Germany. The fruit is rather larger than the French plum, with a thicker skin, and a flatter, narrower stone.

The plum flowers in April, before the leaves, or when they just begin to expand; the fruit is ripe in the autumn.

Nouveau Duhamel, v, p. 189; Koch, Dendrologie, i, p. 94; Flück. & Hanb., Pharmacogr., p. 223; Brandis, Forest Fl. of India, p. 192; DC. Geogr. Bot., p. 878.

Official Part and Name.—PRUNUM; the dried drupe (B. P.). The dried drupe (I. P.). PRUNUM; the fruit (U. S. P.). This fruit is commonly known under the name of Prune or French Plum.

Varieties, Sources, Preparation, and Commerce.—Several varieties of dried plums or prunes are known in commerce, the finer kinds, such as the Saint Catherine and Greengage, being used as dessert fruits; while the *medicinal prunes* of pharmacy, which

are derived from the variety of *Prunus domestica,* termed *Juliana,* by De Candolle, are known in France, under the name of *Prune de St. Julien.* They are chiefly imported into Great Britain and the United States from the South of France, the best coming from Bordeaux.

These plums are dried partly by solar and partly by artificial heat, that is to say, they are exposed on alternate days to the heat of an oven, and on hurdles to that of the sun.

An inferior kind of dried prune is also imported, when French prunes are scarce, from Germany. It is there known as *Quetschen* or *Zwetschen,* and is the produce of *Prunus domestica,* variety *Prunealina* of De Candolle, the *Prunus œconomica* of Borkhausen.

General Characters and Composition.—Dried prunes are somewhat ovoid in form, a little over an inch in length, black, and shrivelled; but when digested in warm water they recover their original form and size. They have a feeble odour; and a sweet, somewhat mucilaginous and acid taste. The pulp, which is tough and of a brownish colour, is that portion in which the properties of the fruit reside, and it is therefore alone employed in the preparation of confections, more especially in the official confection of senna, the lenitive electuary of the old pharmacopœias, which is the only pharmaceutical preparation now recognised.

The inferior prunes termed *zwetschen* or *quetschen* differ from the ordinary French prunes of pharmacy in having a thicker skin, and in being somewhat larger and longer. Hanbury and Flückiger also describe the stone as being "flatter, narrower, pointed at either end, with the ventral suture much more strongly curved than the dorsal."

There has been no special analysis of the French prune of pharmacy; but from the analysis of allied varieties, we conclude the principal constituents to be *saccharine matters, malic acid,* and *pectic* and *albuminoid substances.* The source of its medicinal activity is unknown.

Medical Properties and Uses.—Prunes are nutritious, demulcent, and laxative. They are but little employed by the medical practitioner, but when stewed and sweetened, they are often used

in domestic practice in cases of habitual constipation. They are also useful as a mild and agreeable laxative to children, and during convalescence from inflammatory and febrile diseases. When too largely taken however, they are apt to cause flatulence and griping. They are sometimes added to laxative confections, as the official confection of senna, to improve the flavour and promote the purgative effect; and also for similar reasons to purgative infusions, as the infusion of senna.

Prunes are more digestible than the fresh fruit, which is apt to disorder the bowels if eaten freely, more especially when not quite ripe.

The finer varieties of plums are largely employed as dessert fruits; while the inferior sorts are used for pies, tarts, and other purposes.

Per. Mat. Med., vol. ii, pt. 2, p. 276; Christison's Dispensatory, p. 758; Pharmacographia, p. 223; U. S. Disp., by W. & B., p. 717.

DESCRIPTION OF PLATE.

Drawn from a cultivated specimen; the fruit added from Duhamel.

1. A branchlet in flower.
2, 3. Vertical section of calyx and ovary.
4. A branchlet with ripe fruit.
5. A fruit with half the epicarp removed.
6. Vertical section of endocarp and seed.

(2, 3 enlarged.)

PRUNUS SEROTINA.

N. Ord. *Rosaceæ.*
Tribe *Pruneæ.*
Genus Prunus, *Linn.*

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97. Prunus serotina, *Ehrhart, Beitr. z. Naturkunde,* iii, *p.* 20 (1788).

Wild Black Cherry.

Syn.—P. virginiana, *Mill.* non *Linn.* Cerasus serotina, *Seringe,* C. virginiana, *Michaux* non *Loisel.*

Figures.—Michaux f., N. Amer. Sylva, ii, t. 88; Guimpel, Otto & Hayne, Holzarten, t. 37.

Description.—A large tree, reaching a height of 80 or 100 feet in favorable conditions, but often not more than 30 or 40 feet high, with a straight regular trunk with blackish rugged bark which detaches itself in narrow plates, and numerous spreading branches with red or purplish, shining, smooth bark. Leaves alternate, on rather long slender petioles, stipules linear, laciniate-toothed, quickly caducous, blade 2—3½ inches long, oblong-ovate or broadly oval, rounded or slightly tapering at the base, acute or attenuate at the apex, closely and finely crenate-serrate, with incurved, glandular teeth, quite glabrous, shining, bright green, usually with two small glands on the margin at the base. Flowers rather small, on longish, slender, spreading pedicels, and laxly arranged in narrow, elongated, erect or nodding racemes, 3—6 inches long, terminating or almost constituting lateral branches from the wood of the previous year; bracts minute. Calyx cup-shaped, smooth, with 5 shallow teeth. Petals 5, widely spreading, inserted at the mouth of the calyx-tube, broadly obovate, with a very short claw, pure white, soon falling. Stamens about 20, perigynous, about as long as the petals. Ovary smooth, one-celled with 2 suspended ovules, style simple, very short. Fruit a drupe, about the size of a sloe, globose, smooth, purplish-black, sarcocarp pulpy, stone rounded, ovate. Seed as in the other species.

Habitat.—This, the common wild cherry of North America,

has a very extensive distribution on that continent. It is found throughout Canada, extending almost to the Arctic Circle and reaching from British Columbia to Newfoundland ; in the Northern and Middle United States it is also a common tree, and even extends as far south as Carolina and Florida, where it is rare. It grows in woods, and the pretty flowers appear in May or June, being followed by the racemes of small, slightly bitter cherries in the summer. The tree was introduced into England in 1629, and is not unfrequently seen in gardens and shrubberies.

P. virginiana, Linn. (*P. rubra*, Ait., *P. serotina*, Poir., *Cerasus serotina*, Hook.), is a closely allied species, called "Choke-cherry" in the United States. It differs in being little more than a tall shrub, in having the leaves more sharply toothed, the racemes shorter, and the fruit, which is very astringent till quite ripe, dark red or crimson. It is figured in Guimpel, Otto, and Hayne, Holzarten tt. 36, 78. Both these species are very nearly akin to the common "Bird cherry" of Europe, *P. Padus*, Linn.

Hook., Fl. Boreali-Amer., i, p. 169; Torrey & Gray, Fl. North America, i, p. 410; Chapman, Fl. South. States, p. 120; Lindl., Fl. Med., p. 232.

Official Part and Names.—PRUNUS VIRGINIANA, WILD CHERRY; the bark (U. S. P.). It is not official in the British Pharmacopœia, or the Pharmacopœia of India.

Collection and Preparation.—The best time for collecting Wild Cherry Bark is the autumn, as it then yields most hydrocyanic acid, to which its properties are more especially due. Thus J. S. Perot obtained from the fresh bark gathered in April, 0·0478 per cent. of hydrocyanic acid; from bark in June about twice this amount; and from bark collected in October, 0·1436 per cent., or nearly three times as much. After collection the outer layer of the bark is usually removed, and it is then dried. The inner bark is that which is regarded as the best for use in medicine; but the Pharmacopœia of the United States simply says *the bark*. It is obtained from all parts of the tree indiscriminately, although the bark of the root is supposed to be the most active. As the bark deteriorates by keeping, that

which has been recently dried should be preferred for medical use.

General Characters.—Wild Cherry Bark, as found in commerce, consists essentially of the inner layers (*derm*), but varying portions of the outer bark (*periderm*) are frequently attached to the derm. It occurs in nearly flat, slightly curved, or arched pieces, which vary very much in length, breadth, and thickness. The colour and external characters are also liable to a good deal of variation, according to the size of the pieces and the presence or absence of the outer layers. Thus those pieces which consist essentially of the inner bark present a reddish- or cinnamon-brown colour, and are generally but slightly rough to the touch; but when the outer or suberous layer is attached, the pieces are of a rougher character, and in such parts the colour is redder, and sometimes spotted at intervals with portions of greyish, silvery-white, or brownish patches. Some of the smaller pieces present a uniform reddish-yellow appearance, and are nearly smooth externally. Internally the bark has a deep yellowish or reddish-brown colour, and a more or less roughened character, according to the size of the pieces. The fracture, both transverse and longitudinal, is somewhat close and granular. It is readily powdered, and the powder has a deep fawn colour. The bark has scarcely any odour except when powdered and moistened with water, when it resembles bitter almonds, or peach leaves. Its taste is bitter, slightly aromatic, and agreeable.

When fresh, wild cherry bark is quite white; and has a strong odour of hydrocyanic acid and bitter almonds.

Composition.—The principal constituents of, or which are obtainable from, wild cherry bark, are *tannic acid*, *gallic acid*, *volatile oil*, and *hydrocyanic acid*. The volatile oil and hydrocyanic acid, however, do not exist ready formed in the bark, but are products of the decomposition of *amygdalin*, which, according to Professor Procter, exists in the bark, although it has not, as yet, been isolated. Hence it seems clear, that another principle analagous to, if not identical with, the *emulsin* of bitter almonds, must be also present in the bark, as some such substance is

necessary for the above decomposition to take place. The sedative action which the bark exerts on the heart depends essentially upon the hydrocyanic acid it yields. The volatile oil when deprived of hydrocyanic acid, like the essential oil of bitter almonds, is without any poisonous properties. Wild cherry bark was at one time supposed to contain *phlorizin* or *phloridzin*, a bitter principle found in the bark of the apple, pear, and some other allied trees; but Perot failed to detect any indications of this principle. It is still a question, however, whether the bark does not contain a bitter principle distinct from amygdalin, and to which its tonic properties are due. This opinion is borne out by an experiment of Procter, who found that an extract of the bark retained its bitterness after the whole of the amygdalin had been removed. More recently, J. L. Williams has endeavoured to isolate the bitter principle of this bark, in which, however, he did not succeed satisfactorily. Nothing of a definite nature is known amongst reliable authorities of *prunin*, the so-called active principle of the Eclectic practitioners in the United States, of this bark.

Medical Properties and Uses.—In the United States, wild cherry bark is highly esteemed for its sedative and mildly tonic properties. Dr. Wood, of the United States, thus speaks of its properties and uses:—"This bark is among the most valuable of our indigenous remedies. Uniting with a tonic power the property of calming irritation and diminishing nervous excitability, it is admirably adapted to the treatment of diseases in which debility of the stomach, or of the system, is united with general or local irritation. When largely taken it diminishes the action of the heart, an effect ascribable to the hydrocyanic acid. Dr. Eberle found copious draughts of the cold infusion, taken several times a day, and continued for nearly two weeks, to reduce his pulse from seventy-five to fifty strokes in the minute. The remedy is highly useful, and has been much employed in this country in the hectic fever of scrofula and consumption. In the general debility which often succeeds inflammatory diseases it is also advantageous; and it is well adapted to many cases of dyspepsia. It has been given successfully in intermittent fever,

but is much inferior to cinchona." It is also regarded as a useful remedy in pulmonary consumption, and as a valuable remedial agent in the treatment of functional and organic disease of the heart, when attended with a frequent, irregular, and rather feeble pulse, and an anæmic or otherwise debilitated state of the system. Notwithstanding the testimony borne generally in the United States to the valuable properties of wild cherry bark, it has, up to the present time, been but little employed in this country; it is a remedy, however, which ought to obtain a full and careful investigation.

Per. Mat. Med., vol. ii, pt. 2, p. 279; Per. Mat. Med., by B. & R., p. 815; Pharmacographia, p. 225; U. S. Disp., by W. & B., p. 718; Wood, Therap. & Pharmacology, vol. i, p. 291; Stillé, Therap. & Mat. Med., vol. i, p. 464; Bentley, in Pharm. Journ., vol. v, ser. ii, p. 99; Lancet, vol. i, 1862, p. 159; Proc. Amer. Pharm. Assoc., vol. xxiii (1875), p. 209; Pharm. Journ., vol. iv, ser. 3, p. 44.

DESCRIPTION OF PLATE.

Drawn from a specimen in the British Museum, collected near Boston, Mass. by Dr. Boott.

1. A branch with flowers.
2. A flower.
3. Vertical section of flower, the petals removed.
4. A fruit.

(2, 3 enlarged.)

P.Pl.ar.ad.nat.del. et lith.

M & H Harmart imp

PRUNUS LAUROCERASUS, *Linn.*

N. Ord. Rosaceæ.

Tribe *Pruneæ*.

Genus Prunus, *Linn.*

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98. Prunus Laurocerasus,* *Linn., Sp. Plant., ed.* 1, *p.* 474 (1753).

Cherry-Laurel. Cherry-Bay. Common Laurel.

Syn.—Cerasus Lauro-cerasus, *Loisel.*

Figures.—Woodville, t. 185; Hayne, iv, t. 41; Steph. & Ch., t. 117; Nees, t. 318.

Description.—A shrub or small tree, sometimes reaching nearly 20 feet high, with spreading, slender branches, covered with smooth greyish-brown bark, young branches pale green, perfectly smooth and shining. Leaves evergreen, thick, coriaceous, alternate, on short, stout petioles, without stipules, oblong-ovate, 5—7 inches long, attenuated at both ends, and somewhat recurved at the apex, margin faintly but sharply and distinctly serrate, recurved, upper surface dark green, smooth, and polished, under surface much paler, dull, with a very prominent midrib, on either side of which at the base are one or two small, yellow, rounded, glandular depressions. Flowers about ½ inch wide, on smooth, spreading stalks, somewhat laxly arranged in stiff, erect, oblong racemes from the leaf-axils, bracts small, caducous. Calyx smooth, dark green, with a broadly urceolate tube, and 5 short triangular teeth. Petals 5, small, distantly inserted on the edge of the calyx tube, roundish, with a short claw, spreading, somewhat crumpled, white, reflexed, soon falling. Stamens 20, inserted in a double row on the margin of the calyx-tube, about as long as the petals, spreading, anthers small. Ovary superior, from the base of the calyx-tube, smooth, tapering into the style, 1-celled, with 2 ovules. Fruit a cherry-like drupe, about ⅝ inch in diameter, slightly narrowed at the apex, and with a faint

* *Laurocerasus*, a name given by Clusius, from the laurel-like foliage and cherry-like fruit.

furrow along one side, blue-black, smooth, shining, sarcocarp abundant, pulpy, endocarp hard, smooth, pointed at both ends. Seed solitary, with a thin testa and no endosperm, cotyledons large, plano-convex.

Habitat.—The well-known Laurel of the gardens is a native of the East, being found in woods in Thessaly, Bithynia, Armenia, Northern Persia, and the Caucasian provinces. It was introduced into Europe about 1580, and was known in English gardens very soon after, though it is not included in Gerard's Catalogue (1596) of his own garden. It very rapidly became an almost universally cultivated ornamental shrub, and is now found throughout temperate Europe, being only killed in very severe winters. The plant flowers here in May, and the handsome fruit is ripe in the autumn. Though individually quite like black cherries, their growth in pendulous racemose clusters gives them almost a grape-like appearance.

Clusius, Hist. Pl. Pannon. (1583), p. 1; Boiss., Fl. Orient., ii, p. 650; DC., Prod., ii, p. 450; Ledebour, Fl. Ross., ii, p. 9; Lindl., Fl. Med., p. 232.

Official Part and Name.—Laurocerasi Folia; the fresh leaves (B. P.). The leaves (I. P.). It is not official in the Pharmacopœia of the United States.

General Characters and Composition.—The fresh leaves, which are alone official in the British Pharmacopœia, are inodorous until they are bruised or torn, when they at once emit a ratafia or bitter almond odour. When chewed their taste is bitter, aromatic, and somewhat astringent. When dried their taste is still manifest; but they have no odour when bruised unless water be added, when their characteristic odour is at once evident.

The principal constituent of the leaves is supposed to be *amygdalin*, but this is rather inferred than proved, as that substance has never been obtained from them. They must also contain *emulsin* or some substance analogous to it, but no such constituent has, as yet, been isolated. The nature and reactions of amygdalin and emulsin are described under "Prunus Amygdalus."

The presence of these substances in cherry-laurel leaves is inferred from the fact that when they are cut and crushed and submitted to distillation with water, they yield a volatile oil which, like that produced under the same conditions from bitter almonds, contains hydrocyanic acid, and has always been regarded as identical with the essential oil of bitter almonds. According to Tilden, the crude essential oil of cherry-laurel leaves "consists mainly of *benzoic aldehyd*, accompanied with *hydrocyanic acid* (less than 2 per cent., according to Umney), *volatile oil*, possibly *benzoic alcohol* (perhaps 1 per cent.), and minute quantities of an *odorous resin*." The experiments of Schaer, made at the request of Dr. Flückiger, show that the fresh vigorous unwounded cherry-laurel leaves do not "evolve naturally a trace of hydrocyanic acid, though they yield it on the slightest puncture." According to Christison, the buds and unexpanded young leaves of the cherry-laurel yield ten times as much essential oil as the leaves of twelve months old. The experiments of Broeker also show, that the amount of hydrocyanic acid yielded by the leaves varies with the season, the age of the plant, the character of the soil, and of the weather. He found the proportion of the acid to be obtained from the leaves was greatest in July and August, and least in February.

Besides the above supposed constituents of the leaves, they contain *sugar*, *fat*, and a small quantity of *tannic acid*, hence their watery infusion becomes green by the addition of perchloride of iron.

Medical Properties and Uses.—Cherry-Laurel leaves have similar properties to hydrocyanic acid, and have sometimes been used both internally as a sedative; and externally in the form of a poultice mixed with linseed meal, as an application to painful ulcers, &c. But the official laurel water, which is more commonly and properly termed cherry-laurel water, is the usual form of administration, and is much employed in various parts of Europe. It is applicable in all cases for which hydrocyanic acid is used, and is sometimes regarded as an elegant mode of administering that acid. In this country and the United States its use has

been almost superseded by that of the more definite hydrocyanic acid, in consequence of its uncertain strength from the causes already mentioned, and also from the fact of its strength varying according to its age.

Cherry-Laurel water has been fraudulently used in Paris in the preparation of the cordial called *Kirsch*, in imitation of the genuine cherry cordial, which is so named.

The fresh leaves are sometimes used for flavouring sweetmeats, custards, creams, &c., but they should be employed with caution, as on account of their poisonous properties they may produce injurious, or even fatal effects.

Per. Mat. Med., by B. & R., p. 813; Pharmacographia, p. 226; U. S. Disp., by W. & B., pp. 522 and 1043; Christison's Dispensatory (1842), p. 592; Garot, Annuaire de Thérap., 1843, p. 45; Journ. de Pharm., Juillet, 1861, p. 15, Juin, 1864, p. 520, and vol. xvi, p. 346; Journ. de Pharm. et de Chim., 4 ser., vol. i, p. 33; Br. and For. Med.-Chir. Rev., Oct., 1868, p. 517; Umney, in Pharm. Journ., 3 ser., Jan., 1869; Tilden, in Pharm. Journ., 3 ser., vol. v, p. 761, and Year Book of Pharmacy (1875), p. 88.

DESCRIPTION OF PLATE.

Drawn from a plant in the Royal Gardens, Kew; the fruit added from Nees and Hayne.

1. Portion of a flowering branch.
2. A flower.
3. Vertical section of the same.
4. Transverse section of ovary.
5. Cluster of ripe fruit.
6. A ripe fruit.
7. Same, with half the pulp removed.
8. The stone.
9. The same, with half the endocarp removed.
10. A seed.
11. Transverse, and—12. Vertical section of the same.

(2–4 enlarged.)

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N. Ord. Rosaceæ.
Tribe *Pruneæ*.
Genus Prunus, *Linn.*

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99. Prunus Amygdalus,* *Stokes, Bot. Mat. Med.*, iii, *p.* 101 (1812).

Almond.

Syn.—Amygdalus communis, *Linn.* and many authors. A. amara and A. dulcis, *DC., Fl. Franc.*

Figures.—Woodville, t. 183; Hayne, iv, t. 39; Steph. & Ch., t. 43; Nees, tt. 312 & 313; Berg & Sch., t. 4 d.

Description.—A small tree; bark pale purplish-brown, slightly wrinkled. Leaves broadly or narrowly lanceolate, acute, sharply serrate, thin, bright green, stalked, alternate, fasciculate on the short lateral branchlets, distant on the young terminal ones; stipules linear, acuminate, sharply serrate, deciduous. Flowers nearly sessile, solitary or few together on the sides of the previous year's branches, appearing just before the leaves, surrounded by a few scaly bracts. Calyx reddish, glabrous, the tube urceolate, the segments 5, broadly oblong, blunt. Petals 5, much larger than the calyx-segments, but variable in size, ovate, thin, concave, bright pale pink. Stamens about 30, about half the length of the petals, inserted at the margin of the calyx-tube in two rows. Ovary (and base of simple style) woolly, one-celled, with two ovules attached to the side near the top. Fruit a drupe about 1½ inch long, irregularly ovoid, with a furrow down one side, closely downy when young; sarcocarp leathery, irregularly splitting into two valves when ripe and falling away from the stone; endocarp hard, ovoid, acute, rugged with irregular pits and furrows externally, smooth and shining within. Seed solitary, about 1 inch long, somewhat compressed, pointed at top, blunt at lower end, connected with the side of the endocarp by a broad funicle; chalaza at the round

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* *Amygdalus*, the classical name.

end; testa reddish brown, thin, rough, with ramifying veins from the chalaza; embryo with a small blunt radicle, and two very large plane-convex cotyledons with the flat plumule between them; no endosperm.

There are no structural characters distinguishing the sweet and bitter almond trees, which cannot, therefore, in spite of the different qualities of their seeds, be separated, even as varieties; the bitter almond seed is somewhat smaller than the best varieties of the sweet kind.

Habitat.—The almond tree is considered to be a native of Morocco, Syria, Persia, and Turkestan; it is doubtfully wild in Sicily, Greece, and Anatolia, and is cultivated throughout temperate Europe, including England, where it ripens its fruit in the south only. As an ornamental, early-flowering tree it is very familiar, producing its beautiful flowers in March. The ovary is very frequently abortive, the flowers being practically male, in English gardens.

Amygdalus, as a genus, is distinguished from *Prunus* only by possessing a leathery separable shell in the place of a soft pulp connected with the stone. Boissier, in his 'Flora Orientalis,' describes 17 species.

Boiss., Fl. Orient, ii, p. 641; Seringe in DC. Prod., ii, p. 531; Lindl., Fl. Med., p. 231.

Official Parts and Names.—1. Amygdala Dulcis. The seed of the sweet almond tree, Amygdalus communis, *var.* dulcis, *DC;* 2. Amygdala Amara. The seed of the bitter almond tree, Amygdalus communis, *var.* amara, *DC;* 3. Oleum Amygdalæ. The oil expressed from bitter and sweet almonds (B. P.). 1. The seeds (*Amygdalæ dulces*); 2. The seeds (*Amygdalæ amaræ*) (I. P.). 1. Amygdala Dulcis. The kernel of the fruit; 2. Amygdala Amara. The kernel of the fruit; 3. Oleum Amygdalæ Expressum. The fixed oil obtained from the kernel of the fruit of Amygdalus communis; 4. Oleum Amygdalæ Amaræ. The volatile oil obtained from the kernel of the fruit of Amygdalus communis, variety amara (U. S. P.).

1. Amygdalæ Dulces. *Sweet Almonds.*—These seeds have a

bland, sweetish, agreeable, nutty taste, and when triturated with water they afford a pure white, milk-like emulsion of an agreeable taste, but without any marked odour. They are covered with a scurfy cinnamon-brown skin or testa; this is easily removed by maceration in warm water, together with the thin, closely attached endopleura or inner membrane, and the kernels, which are entirely formed of the embryo as already described, then alone remain. These are termed *blanched almonds.*

There are four varieties of sweet almonds now distinguished in the London market, namely, *Jordan, Valencia, Sicily,* and *Barbary,* which are arranged in the order of their value. The different kinds vary in the form and size of their kernels and in the firmness of their shells. When imported in the shell (endocarp) they are known as *almonds in the shell.*

Jordan Almonds are the finest kind; they are imported from Malaga, and generally without the shell. They differ from all the other varieties by their more oval shape and greater length; hence they are sometimes termed *long almonds.* Jordan almonds are alone official in the British Pharmacopœia, as is indicated by the characters there given and the statement that they come from Malaga.

The other varieties of sweet almonds are shorter and more ovate, resembling in these respects bitter almonds; indeed, it is principally on this account, and in order to guard against any admixture or substitution of bitter for sweet almonds, that Jordan almonds, which from their greater length cannot well be mistaken, are directed to be used in the British Pharmacopœia in the preparations of sweet almonds, which are ordered in that volume.

The principal constituents of sweet almonds are *fixed oil* (see *Oleum Amygdalæ*), *sugar,* and two albuminous substances called *synaptase* or *emulsin,* and *amandin,* which the recent experiments of Ritthausen tend to indicate, are both modifications of *casein.* It would seem also that sweet almonds must contain a very minute proportion of some substance analogous to *amygdalin* (see Amygdalæ Amaræ), as when warmed with solution of potash they yield a small quantity of hydrocyanic acid.

Medical Properties and Uses.—Sweet almonds are emollient and nutritive. They may be employed for the extraction of the fixed oil of almonds, but are rarely used for this purpose on account of their cost being greater than that of bitter almonds, and the residual cake of inferior value.

The principal use of the sweet almond in medicine is for making almond mixture, which is largely used as a demulcent and emollient in pulmonary affections, &c., and is an excellent vehicle for the administration of expectorants, saline refrigerants, &c. For dietetical purposes almonds are employed as a dessert, and for puddings, cakes, &c. When almonds are used for the table they should always be blanched, as their husk possesses irritant properties. An almond cake made from the non-amylaceous powder of the sweet almond has been recommended by Dr. Pavy as a substitute for bread in the treatment of diabetes.

2. Amygdalæ Amaræ. *Bitter Almonds.*—As already noticed, these almonds very much resemble in form and appearance the inferior kinds of sweet almonds, but are readily known from Jordan almonds by being less elongated and more ovate in form. They are distinguished from all kinds of sweet almonds by their bitter taste and by the emulsion which they afford when triturated with water, having a strong odour resembling ratafia, or peach-blossoms, which arises from the production under such circumstances of an essential oil and hydrocyanic acid.

There are three varieties of bitter almonds, namely, *French*, *Sicily*, and *Barbary*, which are placed in the order of their value.

Bitter almonds, like sweet almonds, contain a *fixed oil* (see *Oleum Amygdalæ*), *emulsin*, and *sugar*, but they also contain a crystalline substance called *amygdalin*, which is not a constituent of sweet almonds. It is, therefore, in the presence of this substance that bitter almonds owe their peculiar characteristics. The volatile oil and hydrocyanic acid which are developed when bitter almonds are triturated with water are not contained in these seeds, but are products resulting from the decomposition of amygdalin under the influence of emulsin and water, the emulsin acting as a kind of ferment.

Medical Properties and Uses.—Bitter almonds produce analogous effects to those of hydrocyanic acid; and may be therefore used medicinally in similar cases, but their administration is not desirable, as the amount of hydrocyanic acid generated is liable to great variation, and their effects, therefore, cannot be relied on with the same degree of certainty as those of hydrocyanic acid. In large quantities bitter almonds have caused serious and even fatal consequences, their poisonous effects being similar to those of hydrocyanic acid. In some persons, even in small quantities, they cause nausea, vomiting, purging, and a peculiar eruption like nettle-rash. The emulsion of bitter almonds is, however, a useful lotion in various skin diseases, as herpes, acne, prurigo, &c. Bitter almond paste is said to destroy the odour of camphor, musk, most volatile oils, creasote, &c., and has therefore been used to free mortars, &c., from the odour of assafœtida and other substances possessing a disagreeable smell.

Bitter almonds are also sometimes used for flavouring, scenting, &c., but their principal consumption is for expressing the fixed oil of almonds; the residual cake being also used when mixed with water for the distillation of the *volatile oil of bitter almonds* (see *Oleum Amygdalæ Amaræ*). *Almond powder* is the ground cake; this is employed as a soap for washing the hands and as a lute, &c. The cake after the volatile oil has been distilled may be used as a food for pigs, &c.

3. Oleum Amygdalæ. *Almond Oil.*—Although, as already mentioned, both sweet and bitter almonds are official as sources of almond oil in the British and other pharmacopœias, the oil of commerce is almost exclusively obtained from bitter almonds on account of their less cost and the greater value of their residual cake. The produce of oil is, however, somewhat less from bitter than sweet almonds, for while the latter yield commonly 50 per cent. of oil, the former, according to Umney, only yield about 44 per cent. The oil is rarely expressed in the United States, but is usually imported from Europe. The properties and composition of the oil are the same, whether derived from sweet or bitter almonds. Almond oil is a thin, pale-yellow fluid,

of a specific gravity varying from 0·912 to 0·920, and when fresh it is almost or entirely inodorous, and has a mild, oleaginous, nutty taste. It congeals less readily than olive oil. It is composed almost wholly of oleic acid combined with glycerin. It soon becomes rancid by exposure to the air.

Medical Properties and Uses.—Almond oil possesses the medicinal and dietetical properties of fixed oils generally. When applied locally it is emollient, and when taken in small quantities it is nutritive, and in large doses laxative. It may be employed for the same purposes as olive oil, and when made into an emulsion with mucilage, or yolk of eggs and sugar, it may be used in allaying troublesome cough, &c.

In pharmacy it is employed in the preparation of several of the official ointments.

4. Oleum Amygdalæ Amaræ. *Volatile Oil of Bitter Almonds.*—This oil has already been referred to under the head of Amygdalæ Amaræ as resulting from the decomposition of amygdalin under the influence of emulsin and water, and stated to be obtained by submitting the bitter almond cake left after the expression of the fixed oil to distillation with water, either alone or more commonly with salt. The yield of volatile oil, as shown by the experiments of Umney, is liable to great variation, the amount obtained by him being, in some cases, as much as 0·95 per cent., while in others it was only 0·42 per cent. This volatile oil is a mixture or compound of various substances, as *hydride of benzoyl, hydrocyanic acid, benzoine,* and *benzamide,* and is commonly known as *crude oil of bitter almonds.* It is this oil which is official in the Pharmacopœia of the United States. It has a golden-yellow colour, and varies in sp. gr. from 1·052 to 1·082. Umney gives it from 1·061 to 1·065. This crude oil is highly poisonous on account of the hydrocyanic acid which it contains, the proportion of which, however, varies from 8 to 14 per cent. The hydrocyanic acid is frequently separated by manufacturers from the crude oil, and the oil is then supplied as *oil of bitter almonds free from hydrocyanic acid,* or *purified oil of bitter almonds.* Various processes have been given by different chemists for the separation of hydrocyanic

acid, but all these purified oils are liable to oxidation unless agitated with fused chloride of calcium so as to deprive them of water. Umney gives the sp. gr. of the purified oil as 1·049.

Medical Properties and Uses.—The effects of the unpurified or crude oil of bitter almonds are almost identical with those of hydrocyanic acid, but as the proportion of hydrocyanic in different oils is liable to great variation, it is very rarely or never employed in medicine in this country, although sometimes prescribed both for external and internal use in the United States of America.

The volatile oil of bitter almonds is very largely used for flavouring by the cook and confectioner; and by the perfumer for scenting toilet soap, and for other purposes. When used for flavouring the purified oil ought always to be employed on account of the dangerous poisonous properties of the crude oil. For this purpose an essence of bitter almonds or almond flavour is commonly supplied, which may be prepared by adding one volume of the purified oil to three volumes of rectified spirit.

Per. Mat. Med., vol. ii, pt. 2, pp. 244 and 250; Pharmacographia, pp. 218—221; U. S. Disp., by W. and B., pp. 117, 588, and 590; Per. Mat. Med., by B. and R., pp. 808—811.

DESCRIPTION OF PLATE.

Drawn from a specimen grown in the Royal Gardens, Kew.

1. A flowering shoot.
2. Vertical section of a flower.
3. A branch with young fruit.
4. Ripe fruit with the sarcocarp split away.
5. Section through fruit to show the seed.
6. Seed with one cotyledon removed.

M&N Hanhart imp.

N. Ord. Rosaceæ.

Tribe *Rubeæ*.

Genus **Rubus**,* *Linn.* B. & H., Gen., i, p. 616; Baill., Hist. Pl., i, p. 454. Species variously estimated at 500 or 100, found in all parts of the world.

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100. Rubus villosus, *Aiton, Hort. Kewensis,* ii, *p.* 210 (1789).

Common (American) *Blackberry. High Blackberry.*

Figures.—Barton, ii, t. 39; Bigelow, ii, t. 38.

Description.—A bush 2—7 feet in height, with a woody, horizontal, irregularly nodular, reddish-brown root-stock, and semi-shrubby, biennial, upright, or nearly prostrate, weak, furrowed, smooth, reddish stems, furnished with strong, hooked prickles; the younger branches green, covered with glandular hairs and fine prickles. Leaves alternate, on long, hairy and glandular petioles, with small, lanceolate, acute stipules at the base, trifoliolate, the lower leaflets nearly sessile, sometimes pedately divided into two, the terminal one conspicuously stalked, leaflets ovate, acute, rounded at the base, coarsely and irregular serrate, rough above, hairy and glandular beneath. Flowers varying in number and size, arranged in lax terminal racemose or corymbose cymes, stalks long, hairy, bracts small. Calyx deeply divided into 5 ovate, sharply-pointed segments, shortly hairy externally, smooth within, spreading during flowering, afterwards deflexed, persistent. Petals 5, obovate-oblong or oval, spreading, very shortly clawed, white, soon falling. Stamens very numerous, perigynously inserted on the margin of the short, spreading calyx-tube, filaments long, slender, anthers small, with rounded cells. Carpels numerous, separate, placed on a conical receptacle; ovaries smooth, styles filiform, slightly lateral, stigmas simple. Fruit consisting of numerous separate rounded drupes inserted on the somewhat enlarged and fleshy receptacle, the whole supported by the reflexed persistent calyx, and forming an ovoid or rounded head, deep shining black when ripe; pulp juicy, abundant, endocarp (nut or

* *Rubus*, the classical name for a bramble.

J.Braun ad nat. del. et lith.
M&N.Hanhart imp.

POTENTILLA TORMENTILLA. *Neestl.*

N. Ord. ROSACEÆ.

Tribe *Potentilleæ*.

Genus Potentilla,* *Linn.* B. & H., Gen., i, p. 620; Baill., Hist. Pl., i, p. 466. Species about 150 or more, natives chiefly of the temperate and colder regions of the northern hemisphere.

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101. Potentilla Tormentilla,† *Stokes in Withering, Bot. Arr., ed. 2, p.* 535 (1787).

Tormentil.

Syn.—Tormentilla erecta, *Linn.* T. officinalis, *Curtis.* Potentilla sylvestris, *Necker.*

Figures.—Woodville, t. 181; Hayne, ii, t. 48; Steph. & Ch., i, t. 26; Nees, t. 309 (bad); Curt., Fl. Londin., fasc. 5; Syme, E. Bot., iii, t. 430.

Description.—A perennial herb. Rootstock short, nearly cylindrical, solid, about ½ inch or more in diameter, branched, truncate below, abruptly tapering above, giving off long cylindrical roots below, the upper part with reddish brown chaffy scales; dark brown externally, bright blood-red in the centre. Stems numerous, from the axils of the chaffy scales, very slender, cylindrical, 1 foot or more long, widely spreading or prostrate, pale-green or reddish, shortly hairy, much branched in the upper part. Leaves alternate and shortly stalked below, usually opposite and nearly or quite sessile above, all with lanceolate or oval, entire or palmately toothed stipules, trifoliate, leaflets small, sessile, obovate- or lanceolate-wedge-shaped, entire and tapering below, with a few large teeth above, hairy on both surfaces, silky on the veins beneath, dark green, paler below. Flowers small, scarcely ½ inch wide, on long slender stalks terminating the stems and

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* *Potentilla*, the name of the Silverweed (*P. Anserina*, L.) in the 16th century; from its supposed powerful virtues.

† *Tormentilla*, a pharmaceutical name of the middle ages; from having been employed to relieve the pain (*tormentum*) of toothache, or that of dysentery (*tormina*).

branches (the lower ones apparently coming off opposite the alternate leaves), which repeatedly dichotomise at the opposite leaves, the whole forming a very lax divaricate cyme. Calyx very deeply cut into 4 lanceolate, acute, pale green, hairy, valvate segments, outside of which and alternating with them are 4 other ones about half as long (epicalyx). Petals 4, roundish, with a very short claw, spreading, lemon yellow with the base orange, soon falling. Stamens about 16, inserted on the perigynous rim (disk) of the calyx which is covered with white hairs, filaments slender, shorter than the petals, yellow, anthers short, rounded. Carpels few, about 6—8, distinct; ovary small, tumid, glabrous; styles lateral, erect, yellow, thickened above. Achenia somewhat kidney-shaped, keeled on the back, smooth, brown, with ridged reticulation when dry. Seed solitary, pendulous, radicle superior, no endosperm.

Habitat.—A very common plant in all parts of this country, especially on heaths, dry fields, roadsides and woods, flowering from July till late in the autumn. It is also found throughout the continent of Europe and extends into the arctic regions, Siberia and Iceland, but does not reach N. America. There are several larger varieties with rooting stems, stalked leaves, and sometimes 5 petals, which appear to be intermediate between this species and *P. reptans,* Linn., the common Cinquefoil.

Syme, E. B., iii, p. 146; Hook. f., Stud. Flora, p. 115; Watson, Comp. Cyb. Br., p. 159; Willk. & Lange., Prod. Fl. Hisp., ii, p. 233; Gren. & Godr., Fl. France, i, p. 530; Boiss., ii, p. 717; Lindl., Fl. Med., p. 225.

Official Part and Name.—Tormentilla, *Tormentil;* the rhizome (U. S. P. *Secondary*). It is not official in the British Pharmacopœia, or the Pharmacopœia of India; but it was formerly official in the London, Edinburgh, and Dublin Pharmacopœias.

General Characters and Composition.—Tormentilla rhizome is commonly known in this country as tormentilla root, and in the United States, as *tormentil.* As seen in commerce in a dried state it has usually an irregularly cylindrical form, but is some-

times twisted or more or less branched or tuberculated; it is from one to two inches in length, half an inch or more thick, and gives off below a variable number of small rootlets. It has a dark reddish- or blackish-brown colour externally, and a reddish or flesh-red colour internally; it has no odour, but a very astringent taste.

The principal constituent of tormentil is *tannic acid* in the proportion when dried of nearly 18 per cent.: it also contains, according to Rembold, *kinovic acid;* about 16 per cent. of substance called *tormentil-red,* the red colouring matter of the drug, and having the same composition as rhatany red; and other unimportant constituents. An infusion of tormentil acquires a blackish-green colour on the addition of a persalt of iron. Its properties are essentially due to tannic acid. Boiling water readily extracts its virtues.

Medical Properties and Uses.—Tormentil has long been known as a popular remedy in diarrhœa. It possesses powerful astringent properties; but at present is but seldom prescribed by the regular practitioner, its place being supplied by astringents of foreign origin, such as rhatany, catechu, and kino. We believe it, however, to be one of the best of vegetable astringents, and applicable in all diseases in which this class of medicines is indicated. In the form of decoction it is a valuable internal remedy in diarrhœa and chronic dysentery; a useful wash or gargle in spongy gums and ulceration of the mouth or tongue; and a good astringent injection in atonic leucorrhœa. It is also said to be very efficacious in the dysenteries of cattle.

Tormentil is also used (or was so till very recently) in the Orkney and Faröe islands for tanning; and in Lapland in the preparation of a red dye.

Steph. & Church., Med. Bot., by Burnett, pl. 26; Per. Mat. Med., by B. & R., p. 817; U. S. Disp., by W. & B., p. 868; Amer. Journ. Pharm., July, 1868, p. 311; Ann. der Chem. und Pharm., vol. cxliv, p. 5; Adams, in Pharm. Journ., vol. vi, 2nd ser., pp. 158 and 260; Maisch, in Amer. Journ. of Pharm., March, 1875, p. 109, and Pharm. Journ., vol. v, 3rd ser., p. 986.

DESCRIPTION OF PLATE.

Drawn from a plant collected at Barnes, Surrey.

1. Upper part of flowering stem.
2. Rootstock.
3. A flower.
4. Vertical section of the same, the petals removed.
5. A carpel.
6. Back, and—7. Side view of achene.
8. Section of the same.

(3-8 enlarged.)

M & N Hanhart imp

N. Ord. ROSACEÆ.

Tribe *Potericæ*.

Genus Hagenia,* *Gmelin* (1791). B. & H., Gen. i, p. 622 (*Brayera*); Baill., Hist. Pl., i, p. 450 (*Brayera*). A single species only known.

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102. Hagenia abyssinica, *Willd., Sp. Pl.* ii, *p.* 331 (1799).

Kousso, Kusso, Cosso, Koso (Amhara). *Habbe* (Tigre).

Syn.—Banksia abyssinica, *Bruce* (1790). Brayera† anthelmintica, *Kunth* (1823).

Figures.—Berg & Sch., t. 25 f; Bruce, Travels in Nubia and Abyss., tt. 22, 23, cop, in Lam. Encyclop., t. 311; Hook., Kew Journ. Bot., 1850, t. 10; Baill., l. c., figs. 388–392.

Description.—A handsome tree of about 20 feet high or more; branches cylindrical, the younger ones marked with the ring-like scars of the leaf-sheaths, and silky with long upward-pointing yellowish hairs; the growing extremities and young leaves densely golden-silky. Leaves abundant, closely placed, alternate, 10 or 12 inches long when full grown, pinnate with 3 to 6 pairs of opposite leaflets and an odd one, and, usually alternating with these, pairs of very small leaflets; petiole very broadly winged by the adnate stipules, which are dilated at the base to form a broad sheath embracing the stem, and terminate in short blunt ears; larger leaflets ovate- or lanceolate-oblong, 3 or 4 inches long, sessile and unequally rounded at the base, acuminate at the apex, usually overlapping, strongly and rather bluntly serrate, densely silky on both surfaces when young, but becoming glabrous, except on the veins below, and along the margin which remains strongly fringed. Panicles abundant, erect or spreading, from the axils of the leaves, a foot or more long, unisexual, much branched; rachis and branches

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* Named to commemorate Dr. K. G. Hagen, of Königsberg, a German botanist, who died in 1829.

† Named after A. Brayer, a French physician in Constantinople, who wrote a pamphlet upon the plant, published in 1823.

zigzag, more or less densely hairy or pilose and glandular, with a membranous, ovate, veiny, ciliated, often reflexed bract at the base of every branch, the lower ones sometimes leafy. Flowers very numerous, small, shortly stalked, unisexual, each with two rounded membranous veined bracts at its base, greenish-yellow in the male, tinged with red in the female, inflorescence. Male flowers: calyx with a short tube and 10 segments in two whorls; outer whorl of 5 small, linear-oblong, hairy segments, inner of 5 broadly oval, veiny, ciliate, membranous segments twice as long as the outer, usually reflexed, greenish-yellow; petals 5 inconspicuous, alternating with the inner calyx-segments and much shorter than them, linear-lanceolate, acute; stamens about 15—30, inserted with the petals, which they equal in length, in the contracted throat of the calyx, anthers short; carpels 2 undeveloped or abortive. Female flowers: calyx-tube top-shaped, strongly hairy externally, prolonged above into a constricted neck (disk) closely surrounding the styles, segments 10, in two alternating whorls, the outer 5 (epicalyx) broader and longer than the inner even when in flower, persistent and becoming much elongated in fruit, the inner 5 and the petals as in the male flower; stamens very small, shrivelled and sterile, inserted on the exterior of the disk; carpels 2, distinct, arising from the base of the deep calyx-tube which completely encloses the oblong ovaries though free from them; styles about as long as the ovaries, terminal, projecting out of the constricted neck of the calyx-tube; stigma large, flat, horizontal, with prominent papillæ; ovule solitary, suspended from the inner angle of the 1-celled ovary. Fruit a small, indehiscent, ovoid, acute, membranous achene, enclosed in the desiccated calyx-tube, which is crowned, shuttlecock fashion, with the enlarged dry membranous epicalyx, the segments of which are then $\frac{5}{8}$ inch long and oblong in form, and the shrivelled remains of the inner calyx-segments, petals and stamens. Seed solitary, embryo without endosperm, cotyledons plane-convex, radicle small, superior.

The flowers are said to be sometimes 4-merous, the petals to be occasionally wanting, and a third carpel has been observed in a few flowers. The fruit has been rarely collected, and the specimens

we have examined (collected by Ruppell) appear to be not fully matured.

Habitat.—This remarkable tree is confined to Abyssinia, where it appears to be not uncommon in the higher mountainous districts, flowering in October–December; it is also commonly planted near towns and villages throughout the country, and is said to be very ornamental. We are not aware that any attempt has been made to cultivate the Kousso in this country.

In accordance with the universally recognised rules of botanical nomenclature, we have adopted in the text the oldest available published name; *Banksia* had been already given by the younger Linnæus, in 1781, to a New Holland genus of *Proteaceæ*.

DC. Prod., ii, p. 588; A. Richard, Tent. Fl. Abyss., i, p. 258; Hook., Kew Journ. Bot., 1850, p. 349; Oliver, Fl. Trop. Africa, ii, p. 380; Lindl., Fl. Med., p. 230.

Official Parts and Names.—Cusso; the flowers and tops of Brayera anthelmintica, D. C. (B. P.). The dried flowers and tops (*Cusso, Kousso*) (I. P.). Brayera; the flowers and unripe fruit of Brayera anthelmintica (U. S. P. *Secondary*.)

Collection and Commerce.—Kousso is gathered for use in medicine before the seeds are quite ripe. The female flowers are chiefly collected, although not exclusively so; and then suspended in the sun to dry. Kousso is brought from Abyssinia, packed in boxes, and reaches England by way of Aden or Bombay.

General Characters and Composition.—Kousso, Koosso, Kosso, or Koso, by which names as well as some others this substance is known in commerce, occurs in compressed, unbroken or more or less broken, panicles of flowers; or in somewhat cylindrical rolls, with the parts kept together by transverse bands; or sometimes the flowers are found in a separated state. The bunches and rolls vary in length from 10 inches to a foot, or are sometimes even a foot and a half or more. Commercial kousso has a brownish or greenish-brown colour, with a reddish tinge

in the case of the panicles of female flowers. Both kinds of flowers may be distinguishad in commercial kousso, although, as already noticed, the female flowers are more frequently collected. Panicles of the latter, from their red colour, are known as Red Kousso; while the male flowers are termed Kosso-esels. Kousso has a pleasant herby odour, especially when freshly imported, which has been compared by Pereira to the combined odours of tea, hops, and senna leaves. The taste is not very evident at first, but subsequently bitterish, acrid, and disagreeable.

Kousso has been repeatedly examined by chemists, and among its constituents a *volatile oil, bitter acrid resin, tannic acid,* and a bitter principle called *kwoséine, koussin,* or *kosin,* have been found. The nature and characters of koussin have been variously given by chemists. As obtained by Dr. Bedall, of Munich, in 1862, it occurred in a more or less crystalline whitish powder, which was subsequently found to possess the anthelmintic properties of the drug. As afterwards prepared by Dr. E. Merck, of Darmstadt, and described by Flückiger and E. Buri, *koussin* or *kosin* as termed by these chemists, was either in the form of needles, or of short thick prismatic crystals. These crystals were found to vary somewhat in colour, that of the needles being similar to sulphur, of the larger prisms darker yellow, while some fine portions appeared to be white. The specific gravity of kosin was so considerable that it sank in sulphuric acid; it possessed neither smell nor taste; it was almost insoluble in water, and but very slightly so in alcohol, but readily soluble in benzol, bisulphide of carbon, chloroform, and ether. The investigation of Flückiger and Buri lead to the conclusion, at present, that kosin is an ether of isobutyric acid. This kosin, when chemically pure, which is not the case with Bedall's koussin, has been proved by Professor Buchheim, of Giessen, to be very inferior in its anthelmintic action to it; hence it would appear that pure kosin is in itself almost, if not entirely, devoid of action on the animal economy, but becoming medicinally active when combined with some other constituent of the drug.

Medical Properties and Uses.—Kousso is anthelmintic in its

action. It is said to be effectual in destroying both kinds of tapeworm, namely, the *Tænia solium* and *Bothriocephalus latus;* but as it possesses little or no cathartic power, the subsequent administration of a purgative is generally necessary to bring away the destroyed entozoon. In Abyssinia, the drug, which is usually administered in substance in large doses, has sometimes produced alarming and even fatal results; and in this country its use frequently causes nausea, and sometimes vomiting. It should be taken early in the morning fasting; and the last meal of the previous evening should be slight. It is commonly given in this country in the form of the unstrained infusion of the British Pharmacopœia.

Per. Mat. Med., vol. ii, pt. 2, p. 296; Pharmacographia, p. 228; U. S. Disp., by W. & B., p. 178; Pharm. Jl., vol. x, 1st ser., p. 15; Year Book of Pharmacy for 1875, p. 19; Garr., Mat. Med., p. 254; Per. Mat. Med., by B. & R., p. 823; Ph. Jl., vol. v, 3rd ser., p. 562.

DESCRIPTION OF PLATE.

Drawn from specimens in the British Museum, collected at Dendera, Abyssinia, by Schimper; the fruit added from Berg and Schmidt.

A panicle of male flowers with its subtending leaf.

1. A male flower seen from above.
2. A female flower, vertical section.
3. Vertical section of fruit.
4. Achene.
5. Section of the same.

(1, 2, 5 enlarged.)

D Blair F.L.S. ad nat. del. et lith.

ROSA CANINA. *Linn.*

M & N. Hanhart imp.

N. Ord. Rosaceæ.

Tribe *Roseæ*.

Genus Rosa,* *Linn.* B. & H., Gen. i, p. 625; Baill., Hist. Pl., i, p. 345. Species very variously estimated, natives chiefly of temperate regions in the northern hemisphere.

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103. Rosa canina,† *Linn., Sp. Plant., ed.* 1, *p.* 491 (1753).

Common Wild Rose. Dog Rose.

Syn.—R. lutetiana, *Lem.* R. dumetorum, *Thuil.* R. collina, *Jacq.* R. coriifolia, *Fries*, &c., &c.

Figures.—Woodville, t. 177; Steph. & Ch., t. 100; Hayne, xi, t. 32; Curt., Fl. Lond., fasc. 5; Syme, E. Bot., iii, tt. 472–474.

Description.—A large straggling bush or shrub reaching 10 or more feet high. Stems numerous, much branched, erect, cylindrical, smooth, green or reddish brown, armed with scattered, large, equal, strongly hooked, laterally compressed, stout, red prickles becoming grey when old, not mixed with any small prickles or setæ; branches very long, arched, smooth, pale green or purplish. Leaves rather distant, alternate, stalked, with oblong acute stipules attached to and bordering the petiole, pinnate, with 2 or 3 pairs of opposite leaflets and a terminal larger one; leaflets nearly or quite sessile, oval or oblong-oval, acute, sharply serrate or doubly serrate, rather thin, quite glabrous above, often somewhat hairy beneath but usually without glands, dark green, the petiole smooth or pilose, often with small prickles, reddish. Flowers usually 2 or 3 together, in small cymes, rather large, 1½—2 inches in diameter, on short smooth pedicels without setæ, bracts oval, leaflike, acute, adpressed. Calyx with a dilated urceolate tube contracted above and smooth outside, and 5 spreading, smooth, acuminate, leafy segments with small pinnæ, not

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* *Rosa*, in Greek ῥόδον, the classical name.

† *Canina*; *Rosa canina* was a mediæval name of the wild rose, and is a Latin form of the *Cynorrhodon* of Pliny, κυνόσβατος of Dioscorides and Theophrastus.

persistent in the fruit. Petals 5, broadly obcordate, spreading, concave, imbricate, delicate, usually pale pink, yellowish at base, soon falling. Stamens very numerous, in several rows inserted on the fleshy throat (disk) of the calyx-tube, anthers short. Carpels numerous, crowded over the inner surface of the calyx-tube, covered with long hairs, each with a solitary pendulous ovule, styles lateral, not connected, pilose, stigmas thickened, projecting slightly beyond the mouth of the calyx-tube. Fruit consisting of numerous achenes closely packed and enclosed in the enlarged fleshy calyx-tube, which is urceolate-ovoid or subglobose, narrowed above, truncate at the top and not crowned with the calyx-segments, about $\frac{3}{4}$ inch long, quite smooth, polished, bright scarlet or red, internally covered with long bristly hairs, achenes very hard, ovoid, acute but varying in shape, capped with the withered styles, clothed with long straight hairs, pericarp thick, very hard and bony. Seed solitary, pendulous, with a membranous testa; cotyledons plane-convex, radicle superior, no endosperm.

Habitat.—This is a very common ornament of hedges and copses, open woods and heaths throughout Europe, and extends eastwards into Northern Asia and Persia; it also occurs in North Africa and the Canaries. In this country it is one of our most familiar plants, and is found throughout Great Britain. The delicate flowers are produced in June and July, and the fruit is ripe in October, the pulp scarcely becoming soft before the first frosts.

The dog rose is a very variable plant, its variability showing itself principally in the form of the fruit, the presence or absence of bristles and glands on the peduncles, and the serration, amount of hairiness, &c., of the leaves. On combinations of these and other slight characters there have been founded an almost incredible number of "species," and of these a large number have been detected in England. These British forms have been classed under 29 varieties by Mr. Baker, but the limits are quite arbitrary. Mr. Boswell Syme gives 21 varieties.

The hips of other allied species of wild rose, *e. g. R. arvensis*, L., are probably also collected for use.

Syme, E. Bot., iii, p. 215; Hook. f., Stud. Fl., p. 122; Watson, Comp. Cyb. Brit, p. 164; DC. Prod., ii, p. 613; Gren. & Godr., Fl. France, i, 557; Lindl., Fl. Med., p. 228.

Official Part and Name.—Rosæ Caninæ Fructus; the ripe fruit of the Dog Rose, Rosa canina, *Linn.*, and other indigenous allied species (B. P.). The ripe fruit of Rosa canina (I. P.). It is not official in the Pharmacopœia of the United States.

General Characters and Composition.—The fruits, which are commonly called *hips*, are rounded, somewhat oval, or ovoid in form; and three quarters of an inch or more in length. They are smooth and shining externally, and of a red or scarlet colour. When ripe, and more especially after frost, the part within the external skin is soft and pulpy, of an orange colour, and a sweetish, acidulous, pleasant taste; but it has no marked odour. The fruit has a large cavity in its interior, containing numerous hard, hairy achenes, which are commonly, although improperly, termed seeds. The walls of the cavity as well as the surface of the achenes, are covered with stiff hairs.

The pulp was found by Bilz to contain 3 per cent. of free *citric acid*, 7·7 per cent. of free *malic acid*, 25 per cent. of *gum*, about 30 per cent. of *uncrystallisable sugar;* besides *citrates*, *malates*, *mineral salts*, and other unimportant constituents.

Medical Properties and Uses.—The pulp possesses slightly refrigerant and somewhat astringent properties. The only official preparation of hips is the confection. This is directed, in the British Pharmacopœia, to be made of hips deprived of their seeds (*achenes*); these are removed in consequence of being covered with stiff hairs, which act as mechanical irritants to the bowels when swallowed. This confection is not employed by itself in medicine; but on account of its agreeable taste, it forms a convenient and pleasant vehicle for the exhibition of other remedies; as for a pill basis for insoluble or disagreeable tasting powders, or for the making of linctuses and electuaries.

Formerly when garden fruits were comparatively few and rare, hips were gathered and used in this country and elsewhere, in the preparation of pleasant-tasting preserves, indeed they are still so

employed in Switzerland and some other parts of Europe. Gerarde states that the ripe fruit "maketh most pleasant meats and banqueting dishes, as tarts and such like."

The root was formerly recommended in hydrophobia, whence indeed its specific name *canina*.

Per. Mat. Med., vol. ii, pt. 2, p. 288; Pharmacographia, p. 238; Steph. & Church., Med. Bot., by Burnett, pl. 100; U. S. Disp., by W. & B., p. 741; Gerarde's Herball, by Johnson, p. 1271.

DESCRIPTION OF PLATE.

Drawn from a specimen collected at Tenbury, Worcestershire.

1. A branch with leaves and fruit.
2. A "hip" cut vertically.
3, 4. A fruit (achene).
5. Vertical—and 6. Transverse section of the same.
7. Cyme of flowers.
8. Vertical section of a flower, the petals removed.
9. Anther.
10. Carpel.

(4–6, 9, 10 enlarged.)

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M & N Hanhart imp.

N. Ord. Rosaceæ.
Tribe *Roseæ*.
Genus Rosa.

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104. Rosa gallica, *Linn., Sp. Plant., ed.* 1, *p.* 492 (1753).

French Rose. Provins Rose. Red Rose.

Syn.—R. pumila, *Linn. f.* R. austriaca, *Crantz.* R. cuprea, *Jacq.*

Figures.—Woodville, t. 179 (double fls.); Hayne, xi, t. 30; Steph. and Ch., t. 99 (double fls.); Jacq., Fl. Austr., t. 198.

Description.—A small rather compact erect bush, with numerous stems from a creeping rootstock and short stiff branches, the young shoots armed with short nearly equal straight prickles mixed with glandular setæ, but without any large hooked prickles. Leaves alternate, stalked, with rather large acute-pointed stipules adherent to the petiole, pinnate, with two pairs of opposite leaflets and a terminal one, leaflets shortly stalked or nearly sessile, oval or ovate, rounded at the base, acute at the apex, serrate, stiff, almost coriaceous, keeled, rugose with veins, pale and slightly pilose below, the leaf-serratures not edged with glands. Flowers large on long, setose, thick, upright, terminal and axillary stalks, with 2 or 3 more or less leafy bracts. Calyx with a fleshy dilated urn-shaped tube contracted at its mouth, and 5 spreading ovate acute imbricate divisions, with small leafy pinnæ on the outside margins, glandular-hairy externally, smooth within. Petals 5 (in the wild state), alternate with the segments of the calyx, broadly triangular-rounded, with a small claw, imbricate, spreading, veined, usually dark rich pink with claw pale. Stamens very numerous, inserted in several rows on the fleshy "disk" which lines the throat of the calyx, anthers short, flattened, 2-celled. Carpels numerous, inserted on the base and sides of the calyx-tube, ovaries with a single pendulous ovule, styles lateral, thickened upwards, projecting out of the mouth of the calyx-tube. Fruit composed of numerous 1-seeded indehiscent achenes inclosed in the swollen and fleshy calyx-tube which

is globose or ovoid, smooth, scarlet, and crowned with the persistent calyx-segments.

Habitat.—This species grows in a wild or semi-wild state throughout Europe, except the northern parts (which include the British Isles and Scandinavia), and extends to Greece, the Crimea, and Armenia. It has been in cultivation from a remote period, and there are very numerous double garden varieties of various shades of colour, which have not, however, the fragrance of *R. centifolia*. *R. pumila*, Linn. f., is generally recognised as the original wild form. For use, *R. gallica* is grown near Mitcham, in Surrey, and also in Oxfordshire and Derbyshire. The name Provins is taken from a small town so called in France, where in the middle ages a variety of this rose was grown which was greatly esteemed; at the present day it is extensively cultivated for use at places in Holland and near Paris. Probably *R. gallica* is not specifically distinct from *R. centifolia*.

Lindl., Monog. Ros., p. 68; Seringe, in DC. Prod., ii, p. 603; Boiss., Fl. Orient., ii, p. 676; Flück. & Hanb., Pharmacogr., p. 230; Lindl., Fl. Med., p. 228.

Official Part and Names.—Rosæ Gallicæ Petala; the fresh and dried unexpanded petals (B. P.). The dried petals (*Rosæ Gallicæ Flores*) of the unexpanded flowers (I. P.). Rosa gallica; the petals (U. S. P.).

Collection and Preparation.—Red Rose Petals are directed in the British Pharmacopœia to be collected from plants cultivated in Britain; and at Mitcham, where this plant is principally cultivated, and where it is incorrectly designated as the Damask Rose, the petals are thus collected and dried:—The flower-buds are gathered just before expansion, when they are about the size of a large nutmeg; the petals are then cut off near the base, leaving their whitish claws attached to the calyx. They are then carefully and rapidly dried by the heat of a stove; and when dried they are gently sifted to remove the stamens and other extraneous substances, and are then ready for the market. It is these dried petals of the unexpanded flowers

deprived of their whitish claws, which constitute the ordinary *red rose petals,* or *red rose leaves* as they are frequently called, of the pharmacies. The petals are collected before the flowers have expanded because they are then much more astringent than when obtained from the full-blown flowers ; they are also dried rapidly because slow desiccation injures both their colour and astringency. It has been computed that 2000 flower-buds yield about 10 pounds of dried, or 100 pounds of fresh petals. The petals which are required for the official Confection of Roses are sent to the market in a fresh state.

General Characters and Composition.—As found in commerce, the dried petals are either more or less crumpled and separate, or loosely aggregated together in little cone-like masses. The petals have a rich velvety appearance, are crisp and dry, of a fine purplish-red colour, a fragrant roseate odour, which is principally developed by drying, and a bitterish, feebly acid, and astringent taste. As their colour and other characters are injured by exposure to light and air, they are best preserved in well-closed canisters, or in bottles protected from the light.

According to the investigations of late years, red rose petals contain traces of *tannic* and *gallic acids,* a little *fat, volatile oil, red colouring matter, quercitrin, glucose,* and *quercitannic acid.* The investigations of M. Filhol show that the astringency of red rose petals is more especially due to quercitrin, and not to tannic acid as was previously supposed. The properties of red rose petals are extracted by boiling water. The infusion thus prepared is of a pale red colour, but it becomes of an intense brilliant red or crimson on the addition of sulphuric acid, and also of other mineral and vegetable acids ; and by alkalies it is changed to a bright green colour.

Medical Properties and Uses.—Red rose petals are slightly astringent and tonic. As these properties are, however, scarcely appreciable, they are chiefly employed on account of their colour, and in the form of one of their official preparations as an agreeable vehicle for the exhibition of other more active medicines.

Per. Mat. Med., vol. ii, pt. 2, p. 289; Pharmacographia, p. 231; U. S. Disp., by W. & B., p. 742; Garr., Mat. Med.. p. 250; Pharm. Journ., vol. x, 1st ser., p. 170; Filhol, in Journ. de Pharm., vol. xxxviii (1860), p. 21; Gmelin's Chemistry, vol. xvi (1864), p. 522.

DESCRIPTION OF PLATE.

Drawn from a plant in the Royal Gardens, Kew, flowering in July.

1. A flowering shoot.
2. Section of flower, the petals removed.
3. A petal.
4. A carpel.
5. Anthers.
6. A fruit.

(4 and 5 enlarged.)

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N. Ord. Rosaceæ.
Tribe *Roseæ*.
Genus Rosa, *Linn.*

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105. Rosa centifolia,* *Linn., Sp. Plant, ed.* 1, *p.* 491 (1753).

Cabbage Rose, Damask Rose, Moss Rose, &c.

Syn.—R. muscosa, *Mill.* R. provincialis, *Mill.*

Figures.—Woodville, t. 178; Hayne, xi, t. 29 (single and double flowers); Nees, t. 302; Berg & Sch., t. 34 f; Nouveau Duhamel, vii, t. 12.

Description.—A small shrub, 3—6 ft. high, with numerous erect branches, rather densely covered with prickles of various sizes and the larger ones hooked, mixed with glandular setæ. Leaves much as in *R. gallica*, but the serratures on the margin fringed with glands. Flowers large, mostly very double, usually somewhat drooping; peduncles covered with numerous setæ and glandular hairs, as is also the calyx-tube. Petals usually very numerous, large, thin, and delicate, clear rose-pink or white, often passing gradually into stamens through many intermediate organs. Fruit oblong or ovoid-oblong, orange-red when ripe; structure as in the last species.

Habitat.—Little is known with certainty as to the origin of this plant, the most anciently cultivated of all the garden Roses. There is a general belief that it is derived from no native European species but from an oriental source, and it is possible that the wild stock has been correctly recognised in a plant of Persia, Assyria, and the East Caucasian regions. The garden varieties are innumerable, and from crossing with the Tea Roses (*R. indica*), and the varieties of *R. damascena* and *R. gallica*, it has now become impossible to refer many of these to any definite species. Hence we find botanists varying considerably in their views. Though some consider *R. gallica* and *R. centifolia* distinct

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* *Centifolia*, from the numerous petals, a term applied to the rose by Pliny.

species, the most general and best supported opinion combines them. Thus Regel considers the latter as a variety of *R. gallica*.

It is not necessary here to go into this question or to mention many of the varieties. The official plant is the old Cabbage Rose of our gardens, the flowers usually large and very double, and carmine-pink in colour. It is grown at Mitcham, Fulham, &c., in small quantity, the great cultivation being carried on at the flower-farms in the South of France.

Of the other garden roses referred to *R. centifolia*, the most remarkable are the Moss Roses, in which the setæ of the peduncles and calyx become hypertrophied, branched, and increased in number so as to form a moss-like covering, and the Pompon Roses, dwarf bushes with very small flowers.

R. damascena, Mill., is probably a distinct species originally, but in the gardens it has contributed to produce the multitude of hybrid forms now cultivated. Mr. Baker has recently corroborated the statement that the Rose cultivated on the lower slopes of the Balkans in Roumelia for the production of "Attar of Rose" is to be referred to this species, which, however, he regards as merely a cultivated race of *R. gallica*.

Seringe, in DC. Prod., ii, p. 619; Lindl., Mon. Ros., p. 64; Boiss., Fl. Orient., ii, p. 676; Regel, Tent. Ros. Monog., p. 70; Baker, in Journ. Bot., 1875, p. 8; Lindl., Fl. Med., p. 228; Flück. & Hanb., Pharmacogr., p. 232.

Official Parts and Names.—Rosæ Centifoliæ Petala; the fresh petals, fully expanded (B. P.). The fresh fully expanded petals (I. P.). 1. Rosa Centifolia; the petals: 2. Oleum Rosæ; the volatile oil obtained from the petals (U. S. P.). In the British Pharmacopœia, and in the Pharmacopœia of India, the petals are termed Cabbage Rose Petals, and petals of the Hundred-leaved Rose; and in the Pharmacopœia of the United States they are known as the petals of the Pale Rose. At Mitcham, where the plant is cultivated, it is called the Provence Rose.

1. Rosæ Centifoliæ Petala.—*Collection and Preparation.*—In the British Pharmacopœia, Cabbage rose petals are directed to be obtained from plants cultivated in Britain. Their odour is

strongest when they are of a fine pale red colour, and previous to their beginning to fade; hence they should be gathered when the flowers are fully expanded, and before the petals begin to fall. By drying, the petals turn to a brown colour, and their fragrance is diminished; they may, however, be preserved for some time in a fresh state, by compressing them with alternate layers of common salt in a closely stopped vessel. Hence, Rose water, which is the only official preparation in the British Pharmacopœia, is directed to be distilled from the fresh petals, or an equivalent quantity of the petals preserved while fresh with common salt.

General Characters and Composition.—Cabbage rose petals are thin and delicate, and when fresh, delightfully fragrant; they have a sweetish, slightly acidulous, somewhat astringent, bitterish taste.

In chemical composition cabbage rose petals agree generally with red rose petals. The former yielded Enz *malic, tartaric,* and *tannic acids; fat, resin,* and *sugar.* Their odour is due to a *volatile oil,* which they contain, however, only in very small proportion. When the distillation of rose-water is carried on a large scale in this country, a small quantity of oil is obtained of a butyraceous consistence, and a faint rose-like, but scarcely agreeable odour. This oil is principally composed of an inodorous stearoptene; it is of no value as a perfume like the deliciously fragrant *Attar* or *Otto of Rose,* described below under the head of "Oleum Rosæ."

Medical Properties and Uses.—Cabbage rose petals are said to be mildly laxative, and were formerly prescribed in this country in the form of the official syrup. This preparation has, however, been omitted from the British Pharmacopœia. But the petals are still retained as a constituent of the compound syrup of sarsaparilla of the Pharmacopœia of the United States, doubtless, in some degree, from their reputed laxative properties. Their use, however, at the present day, is essentially in the preparation of the official rose water, which, on account of its agreeable odour, forms a pleasant vehicle for the exhibition of medicines used in the form of

collyria and other lotions. Rose water is also employed in the British Pharmacopœia as a flavouring ingredient in the official preparations of compound mixture of iron and of bismuth lozenges.

Cabbage rose petals and rose water are also in frequent use by the perfumer.

Per. Mat. Med., vol. ii, pt. 2, p. 293; Pharmacographia, p. 232; U. S. Disp., by W. & B., pp. 742 and 1045.

2. Oleum Rosæ.—Oil of Roses is only official in the Pharmacopœia of the United States; it is commonly known as *Attar* or *Otto of Rose*. Although *Rosa centifolia* is stated to be its botanical source, the exact species or variety from which it is obtained has not in all cases been determined; but the rose cultivated in Roumelia for the production of otto of rose has been ascertained by Hugo Mohl and Baker to be *Rosa damascena*. Brandis also states, that the species cultivated in India for the production of otto is *Rosa damascena*.

Production.—Otto of Rose of commerce was, until the late war between Russia and Turkey, almost entirely obtained from a small region, of which Kizanlik is the principal town and seat of trade, in the province of Roumelia, on the southern side of the Balkan mountains. The supply was necessarily interrupted during the war; but it is said that this year (1878) the yield is but little inferior to that of former years. It is also largely produced in India, and to some extent near Tunis, in the South of France, and in other parts; but the otto of these districts is almost, if not entirely, consumed in the countries whence it is obtained. In this country and in the United States, the oil which is produced when the petals of the cabbage rose are distilled on a large scale in the preparation of rose water, is, as already stated, of no value as a perfume. In Roumelia, according to Baur, and others, the following is the mode adopted for obtaining the otto: The roses are collected in April and May, and on each day before sunrise; they are distilled, frequently without removing their calyces, either immediately, or on the same day in which they are gathered. For this purpose they are placed with about double their

volume of water in a tinned copper still, the head of which communicates with a refrigerator, which is simply a straight tin pipe passing obliquely through a tub fed with a supply of running water. The heat is applied over a common fire for about an hour and a half, and the product of the distillation received in a long-necked glass flask. The first portions of the distillate are returned to the still; the second portion is set by for a day or two, and kept at a temperature not lower than 60°, in order that the oil may separate. The oil in a fluid state is then skimmed from the surface of the water, in which it has collected, by means of a very small tin funnel having a fine orifice, and furnished with a long handle. It is then in a condition for sale. The produce is said to vary much, but, according to Baur, it averages 0·04 per cent.; and the annual amount obtained from Roumelia before the war was, about 4000 avoirdupois pounds, the value of which may be estimated at £60,000.

General Characters and Composition.—Otto of rose is a bright oily liquid, of a pale yellow colour, and with a specific gravity of from 0·87 to 0·89. Turkish otto is dextrogyre. When the temperature is reduced otto of rose becomes solid, owing to the separation of brilliant, light, crystalline plates of stearoptene. The temperature at which the oil concretes is, according to Baur, at from about 52° to 60°. Hanbury found the fusing point of true Turkish otto to vary from about 60° to 64°; that of a sample from India to be about 68°; that of oil distilled in the South of France to vary from 69·8° to 73·4°; that of oil produced in Paris to be 84°; and that of oil obtained in London in distilling rose water to vary from 86° to about 90°. Hence it appears that the fusing point of otto of rose becomes higher the more northerly is the country of its production. In bulk the odour is almost too powerful to be agreeable; but when diffused through the air, or properly diluted with some liquid, it is most delicious.

Oil of roses is a mixture of a *stearoptene hydrocarbon*, which is scentless when pure; and of an *oxygenated liquid hydrocarbon* to which its odour is due. The proportion of these two oils varies much, according to the country where the otto is produced, the

state of the weather when the roses are gathered, and from other circumstances but little understood. The principal influence is, however, exerted by the country whence it is produced; thus, while Turkish otto of rose contains about 18 per cent. of stearoptene, the proportion of this hydrocarbon in French and English oil has been found to vary from 35 to 68 per cent. Hence we find that one of the principal causes of the inferiority of the oils of roses as obtained in cool northern climates is the large proportion of odourless stearoptene which they contain. The larger proportion of stearoptene in such oils also leads to their becoming solid at higher temperatures than Turkish oil. It follows, therefore, that good otto of rose cannot be produced in cool northern countries.

Adulteration.—Otto of rose is largely and systematically adulterated in Turkey with the so-called oil of geranium, which is the produce of *Andropogon pachnodes,* Trin. (*A. Schœnanthus,* Linn.), an Indian grass, which is described by us under '*Andropogon Nardus.*' This oil is known in India as *Rusa oil,* or *Rusa ka tel*; it is imported into Turkey for the express purpose of adulterating otto of rose. Geranium oil does not become solid by being exposed to cold, hence when it is added to otto of rose the latter is less disposed to crystallise; and this leads again to the dealers in Turkey preferring an inferior otto, that is, one obtained from the mountain districts, which, from containing a larger proportion of stearoptene, will bear a larger dilution with the grass oil without crystallising. Spermaceti is also sometimes added to replace the stearoptene in oils adulterated largely with the so-called geranium oil.

Properties and Uses.—Otto of rose is only used in medicine for scenting ointments and cerates, and in certain spirituous preparations for internal use. Rose water is sometimes made by distilling oil of roses with water; but the product is not so good as that obtained in a similar way from the petals.

The chief use of otto of rose is in perfumery, where it is extensively employed. It is also much employed for scenting snuff.

Per. Mat. Med., vol. ii, pt. 2, p. 294; Pharmacographia, p. 233; U. S. Disp., 14th ed., by W. & B., p. 638; Piesse, Art of Perfumery, p. 130; Baur, Neues Jahrbuch für Pharmacie, xxvii (1867), and Pharm. Journ., ser. 2. vol. ix, p. 286; Hanbury, in Pharm. Journ., ser. i, vol. xviii, p. 504; Gladstone, in Journ. Chem. Soc., vol. x (1872), p. 12; Flückiger, in Pharm. Journ., ser. 2, vol. x, p. 147; Senier, in Pharm. Journ., vol. vii, ser. 3, p. 650.

DESCRIPTION OF PLATE.

Drawn from a garden specimen.

1. A twig with flowers.

2–7. Series showing transformation of stamens into petals.

M&N Hanhart imp

PYRUS CYDONIA. *Linn.*

N. Ord. Rosaceæ.

Tribe *Pomeæ*. Lindl., Veg. Kingd., p. 559 (N. Ord. *Pomaceæ*).

Genus Pyrus, *Linn.** B. & H., Gen. I, t. 626; Baill., l. c., pp. 392 & 463. Species about 40, natives of the temperate regions of the northern hemisphere.

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106. Pyrus Cydonia,† *Linn., Sp. Pl., ed.* 1, *p.* 480 (1753).

Quince.

Syn.—Cydonia vulgaris, *Pers. & other authors.* C. europæa, *Savi.* Sorbus Cydonia, *Crantz.*

Figures.—Woodville, t. 182; Hayne, iv, t. 47; Steph. & Ch., t. 115; Nees, t. 305; Berg & Sch., t. 46 c; Berg, Charact., t. 63, f. 479; Bot. Reg., t. 905; Jacq., Fl. Austr., t. 312.

Description.—A bush or small tree with spreading branches, the bark purplish-brown, thin, the young twigs covered with a dense, yellowish-grey tomentum. Leaves shortly stalked, entire, ovate, blunt or acute, 1½—2½ inches long. Stipules roundish or oblong-oval, serrate and denticulate, with marginal glands; petioles and under surface densely covered with short, thick, yellowish wool, which when the leaves are young also covers their upper surface. Flowers usually solitary at the ends of the branches, with several bracts at the base of similar form to the stipules. Calyx-tube globular-ovoid, densely tomentose. Teeth 5, large, oval-oblong, acute, glandular-serrate, foliaceous, reflexed during flowering, persistent. Corolla of 5 petals, more than 2 inches across. Petals round-obovate, woolly at the base, white or pink. Stamens about 20 in two rows, the inner ones shorter, inserted on the prominent rim of the calyx-tube (hollow receptacle). Ovary surrounded by the thick "calyx-tube," 5-celled, ovules numerous in two rows in each cell, ascending; styles 5, densely woolly below; stigmas capitate. Fruit a large pome, woolly when young, some-

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* *Pyrus*, a pear tree; the classical name.

† From Κυδώνια, a town in Crete, where, according to Pliny, this shrub was indigenous.

times apple-shaped, more usually pyriform, bright golden yellow, very fragrant, crowned with the persistent leafy calyx-segments; flesh yellowish; endocarp cartilaginous, surrounding the cells. Seeds about 12 or 14 in each cell, somewhat coherent and flattened by mutual pressure, pointed at the hilum, and marked on one side at the other end by the chalaza, with a ridge, the raphe, connecting these two points; testa brown, cartilaginous, covered with an epidermal layer of a single row of cylindrical cells, which swell up into a mucilage if treated with water; embryo entirely filling the seed, cotyledons large, radicle prominent, pointing to the hilum.

Habitat.—The native country of the quince is doubtful, but, like so many other fruits, it appears to be wild in some of the Caucasian provinces, Persia and Asia Minor. It was very anciently cultivated, and is now found apparently wild throughout the Mediterranean region, and in gardens in all temperate parts of Europe, and many parts of Asia and America. It produces fruit abundantly in the South of England.

Cydonia as a genus differs from *Pyrus* (in which it is now usually included) only in the cells of the fruit containing numerous seeds instead of two. Four species are known. The structure of the seed-coat is figured in Berg's 'Characteristik' quoted above.

DC. Prod., ii, p. 638; Boiss, Fl. Orient., ii, p. 656; Wenzig in Linnæa, xxxviii (1873), p. 7; Gren. & Godr., Fl. France, i, p. 569; Lindl., Fl. Med., p. 234.

Official Part and Name.—Cydonium. The seed (U. S. P. *Secondary*). Not official in the British Pharmacopœia, or the Pharmacopœia of India.

Commerce.—Quince seeds are imported into England from the South of France, from the Cape of Good Hope, and from Hamburg, where they are known as Russian quince seeds. They are largely imported into India from the Persian Gulf, and by land from Affghanistan.

General Characters and Composition.—Quince seeds of commerce are flattened, ovate, acute, more or less angular, and mahogany or reddish-brown in colour. They have no odour, and only a simply

mucilaginous taste when unbroken, but when bruised and rubbed up with water the kernels have the odour and taste of bitter almonds, from the formation of hydrocyanic acid.

The seed-coats contain so large a quantity of mucilage that it is said that the seed readily coagulates forty times its weight of water. Pereira considers this mucilage as peculiar, and calls it *cydonin*. Hanbury and Flückiger regard it as a soluble modification of cellulose.

Medical Properties and Uses.—Quince seeds are only employed in medicine on account of their mucilage, which possesses emollient and demulcent properties. In this country they are only used externally in the form of a decoction, which is commonly known as mucilage of quince seeds, as a demulcent in skin diseases, affections of the eye, erysipelas, and other cases where mucilaginous applications are useful. In the United States infusion of sassafras pith is preferred to quince mucilage in such cases. Quince seeds are highly valued by the Mahomedans in India and all over the East, as a demulcent tonic and restorative. Europeans have also employed them with success in dysentery. The mucilage of quince seeds is one of the substances used by hair-dressers under the name of *bandoline*, for dressing the hair, &c.

Quince fruit must be carefully distinguished from Indian Bael fruit, which is known in India as the Bengal quince. Quince fruit is not eatable in its raw state on account of its strong odour and astringent taste, but when stewed in pies and tarts with apples it is much esteemed. An excellent marmalade is also prepared from the pulp (*miva cydoniarum*); indeed, it is said that the name of marmalade was originally derived from *marmelo*, the Portuguese name of the quince.

Pharmacographia, p. 240; Per. Mat. Med., vol. ii, part 2, p. 304; Per., by B. & R., p. 826; U. S. Disp., by W. & B., p. 358; Pharm. of India, p. 86.

DESCRIPTION OF PLATE.

Drawn from a plant in the Royal Gardens, Kew. 1. Branch with foliage and young flowers. 2. Vertical section of flower, petals omitted. 3. Transverse section of ovary. 4. Ripe fruit. 5. Section of same. 6, 7. Seed. 8. Vertical section of same. (2, 3, 7, 8 enlarged.)

D Blair Ft. S ad nat. del. et lith

LIQUIDAMBAR ORIENTALIS, Mill.

M & N Hanhart imp.

N. Ord. HAMAMELIDEÆ. Lindl., Veg. Kingd., p. 253 (*Altingiaceæ*); Le Maout & Dec., p. 411 (*Balsamifluæ*).

Genus Liquidambar,* *Linn.* B. & H., Gen., i, p. 669. Species 3, one North American, two Asiatic.

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107. Liquidambar orientalis, *Miller, Gard. Dict., ed.* 8 (1768).

Syn.—L. imberbe, *Aiton.*

Figure.—Pococke, Description of the East, ii, t. 89?; Pharm. Journ., xvi, p. 462, reprod. in Bonplandia, v, p. 119; Hook., Ic. Plant., t. 1019.

Description.—A much-branched tree, reaching a height of 40 feet or more, with a thick, purplish-grey bark, which does not exfoliate; young branches and buds glabrous. Leaves alternate, scattered, petioles 1½—2 inches long, slender; stipules large, membranous, forming scales to the buds and quickly deciduous; blade 2—3 inches long by 4—5 wide, palmately cut about half way down into 5 nearly equal, broad, blunt divisions usually again 3-lobed, margin finely and shallowly serrate-crenate, bright green, smooth on both surfaces, or with tufts of hair beneath in the axils of the prominent veins. Flowers unisexual, monœcious, small, sessile, arranged in little, round, solitary heads, terminating longish peduncles from the axils of the very young leaves, the male flowers each subtended by an ovate bract; the heads of female flowers with four spreading, oblong-oval bracts at the base; bracts hairy outside, smooth within. Male flowers:—Calyx and petals absent; stamens numerous, crowded on a small receptacle; filaments short, slender; anthers broad, quadrangular, basifixed, 2-celled, dehiscing longitudinally; no pistil. Female flowers:—Calyx tubular, short, truncate at the mouth, intimately fused with the adjacent ones; petals absent; stamens represented by 4—9 small, rudimentary anthers round the margin of the calyx, or absent; pistil composed of two carpels; ovary enclosed in and united with the calyx (half inferior), 2-celled, with numerous

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* *Liquidambar* is given by Monardes in the 16th century as the name of the resin obtained in Mexico from the American species, now *L. styraciflua.*

ovules in two rows in each cell; styles distinct, spreading or erect, tapering, recurved, stigmatiferous along the inner surface, persistent. Head of fruit globular, pendulous, about 1 inch in diameter, hard and woody, consisting of the indurated, fused calyx-tubes and the half-immersed capsules, each terminated by the 2 hardened spinous styles; capsule 2-celled, free above, and widely dehiscing septicidally. Seeds several in each cell, flattened, with a short wing at one end, embryo straight, with flat cotyledons, and a superior radicle in the axis of the scanty endosperm.

Want of material has compelled us to take the description of the flowers from other authors.

Habitat.—Though its product has been an article of trade from remote antiquity, this tree was not known botanically till about the middle of the last century, when Miller (who received seeds from Richard in Paris, who had them from the Levant) grew it in Chelsea Gardens. About the same time it was introduced into Kew and other botanic gardens.

It appears to inhabit a very restricted portion of Asia Minor, on and near the coast in the south-west, and has not with certainty been found wild in any other part of the East. Here it forms forests near Budrum (Halicarnassus), Melasso, Moughla, Marmorizza, and a few other places in the same neighbourhood. It is not known to occur in any of the islands of the Archipelago, nor in Rhodes or Cyprus.*

The similarity of the genus *Liquidambar* to *Platanus*, the Planes, is very striking, and is carried out also in the geographical distribution.

This oriental species is very remarkably allied to the American one, *L. styraciflua*, L., from which it differs in the form of the leaves and their smoothness, and in the smaller head of fruit.

For all relating to the history of this and other "storax-pro-

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* The plate quoted above from Pococke's travels (1745) as doubtfully a figure of the present species was drawn from a tree met with in Cyprus, and not elsewhere. Pococke called it *Platanus orientalis*. As old planted trees of the American *Liquidambar styraciflua* are well known in Cyprus, it is possible that Pococke's plate may represent that species; but *L. orientalis* may really grow there.

ducing" plants reference must be made to the admirable and exhaustive memoir of D. Hanbury quoted below.

Pococke, Description of the East, i, p. 230; P. Miller, Gard. Dict.; Aiton, Hort. Kewensis, v, p. 306; A. DC., in DC. Prod., xvi, 2, p. 158; Boissier, Fl. Orient., ii, p. 819; Oliver, in Hook. Ic. Plant., xi, p. 13; Lindl., Fl. Med., p. 321; D. Hanbury, in Pharm. Journ., xvi (1857), pp. 417, 461, and xxii (1863), p. 436; Flück. & Hanb., Pharmacogr., p. 241.

Official Part and Names.—STYRAX PRÆPARATUS; a balsam obtained from the bark, purified by means of rectified spirit and straining (B. P.). A balsam obtained from the bark, purified by rectified spirit and straining (I. P.). STYRAX; a balsam prepared from the bark (U. S. P.).

Extraction and Commerce.—The investigations of Hanbury have proved that the solid storax of the ancients, which was derived from *Styrax officinale,** and always scarce and valuable, has in modern times entirely disappeared from commerce; and been replaced by the balsam obtained from the tree now under description. Its extraction is carried on chiefly by a tribe of wandering Turcomans called *Yuruks,* in the forest of the south-west of Asia Minor. The mode in which it is procured is derived from information communicated to Hanbury by Maltass and McCraith, of Smyrna, and by Campbell, the British Consul at Rhodes, and is as follows: —The outer bark of the tree being removed, the inner bark is stripped off and thrown into pits, until a sufficient quantity has been collected. Maltass states that it is then packed in strong horsehair bags, and submitted to pressure in a wooden press. After removal from the press, hot water is thrown on the bags, which are then pressed a second time, when the greater part of the balsam will have been extracted. But according to McCraith

* Although the source of the solid storax of the ancients had been commonly referred, and Hanbury thought correctly, to the *Styrax officinale,* Linn., he repeatedly failed to obtain personal and ocular demonstration of the fact by the examination of trees in the south of France, Asia Minor, and Syria. Great therefore, says his biographer, Joseph Ince, "was his exultation when walking in his brother's garden at Mortola, near Mentone (December 9th, 1874), to find and to be able to collect some resin of *Styrax officinale* which exuded from the stem of a young tree."

and Campbell, the bark is first boiled in water in a large copper over a brisk fire, by which process the balsam is separated, and can then be skimmed off. The boiled bark is afterwards put into bags, over which hot water is thrown, and submitted to pressure as described above, by which an additional quantity of balsam, or as it is termed *Yagh*, i. e. *oil*, is obtained. In either mode of proceeding the product is the semi-liquid opaque substance called *Liquid Storax*. This is chiefly forwarded in barrels to Constantinople, Smyrna, Syra, and Alexandria. Some is also exported to Smyrna packed in goat skins, with a certain proportion of water; it is then placed in barrels, and shipped mostly to Trieste. Liquid Storax also finds its way to Bombay by way of the Red Sea, and is thence exported to China. But little storax is consumed in this country or in the United States; but the chief markets for the balsam are India and China. Liquid Storax is known in the East under the singular name of *Rose Malloes* or *Rosa Mallas*.

The residual bark left after the extraction of the balsam constitutes the fragrant foliaceous cakes, known to pharmacologists as *Cortex Thymiamatis*, *Cortex Thuris*, and *Storax bark*.

General Characters and Adulterations.—Liquid Storax, as imported, is a soft viscid opaque substance, about the consistence of honey, and of a greyish-brown colour. It always contains a variable quantity of water, which, after it has been allowed to stand for some time, floats on the surface. It has an agreeable balsamic odour, which is more especially evident after it has been long kept, for when fresh its natural fragrance is contaminated to some extent by the odour of naphthalin or bitumen. It has a burning, pungent, and aromatic taste. It is frequently adulterated by the admixture of sand, ashes, and other substances, hence the official storax is directed to be obtained from liquid storax by means of rectified spirit and straining. It is then called Prepared Storax, and its characters are thus given in the British Pharmacopœia:—"A semitransparent brownish-yellow semifluid balsam, of the consistence of thick honey, with a strong agreeable fragrance, and aromatic bland taste. Heated in a test tube on the vapour bath, it becomes more liquid, but gives off no

moisture; boiled with solution of bichromate of potash and sulphuric acid it evolves the odour of hydride of benzoyl." Liquid Storax is, however, commonly prepared by heating it until the water with which it is always mixed is evaporated, and then straining it. Storax thus prepared has a dark brown colour, and becomes transparent, but it loses, to a great extent, its agreeable odour.

Composition.—The principal constituents of liquid storax are *styrol, styracin, cinnamic acid,* and *resin,* hence it is properly termed a balsam. *Styrol, cinnamene,* or *cinnamol,* is a colourless, volatile liquid, a hydrocarbon, having a sp. gr. of 0·924, and a boiling point of about 295°. It has the odour and burning taste of liquid storax, and is obtained by distilling that substance with water. By the oxidising action of chromic acid it yields benzoic acid, hydrocyanic acid, and bitter almond oil. Styrol is the most important constituent of liquid storax. *Styracin* or *cinnamylic cinnamate* is a crystalline solid, or it sometimes exists in a liquid uncrystallizable state. It is resolved by the action of a concentrated solution of potash into a *cinnamate* and *styrone* or *cinnylic alcohol.* It is insoluble in water, but soluble in ether, and to some extent also in alcohol. When pure it is without taste or odour. *Cinnamic acid* has been already referred to by us as a constituent of the balsams of Peru and Tolu; its proportion in liquid storax is commonly estimated at from 6—12 per cent., but according to Löwe, it is as much as 23 per cent. It is inodorous, but with an acrid taste; readily soluble in alcohol, ether, or hot water, but sparingly so in cold water. It fuses at 264°. The proportion and properties of the resin have not been determined. *Benzylic alcohol* is also, according to Laubenheimer, a probable constituent of liquid storax.

Medical Properties and Uses.—Liquid storax is a stimulant expectorant like the balsams of Peru aud Tolu, and Benzoin; but it is very little prescribed at the present day, except as an ingredient of the Compound Tincture of Benzoin. It is said to be useful in chronic bronchial affections. It has also been recommended as a remedy in diphtheria, and as a substitute for copaiba in gonorrhœa and leucorrhœa. Of late years storax has

also been successfully used as a local application for the cure of scabies, for which purpose it should be mixed with olive or linseed oil; or for children, with an equal part of a mixture of hard-boiled yolk of egg and glycerine ointment. Liquid storax is also used to some extent in perfumery.

Other Kinds of Storax.—Several other kinds or preparations of storax may occasionally be met with, but their use has now become almost obsolete, except in the East, where they are still in some demand. The only kind that calls for any notice from us is *Styrax calamita*. When pure this consists of liquid storax mixed with the residual liquidambar bark already referred to under the name of *Cortex Thymiamatis*, reduced previously to coarse powder; or when that bark is scarce common sawdust is substituted for it. This kind of storax is chiefly manufactured at Trieste, but also at Venice and Marseilles. It is imported in wooden drums; and is found in large cylindrical cakes of a reddish-brown colour. It is brittle and friable, and easily rubbed into a coarse kind of powder, although it is soft and unctuous to the touch. After exposure to the air for a short time it becomes covered with a whitish kind of mouldiness, which is due to small silky crystals of styracin.

Per. Mat. Med., vol. ii, pt. 1, p. 677; Per. Mat. Med., by B. & R., p. 489; Pharmacographia, p. 241; U. S. Disp., by W. & B., p. 842; Hanb., in Pharm. Journ., ser. 1, vol. xvi, pp. 417 and 461, and ser. 2, vol. iv, p. 463; Hanb. Science Papers, by Ince, p. 8; Gmelin's Chem., vol. xiii, p. 286; Ann. d. Chem und Pharm. (1872), p. 289; Toel, in Chem. Gaz., July 2, 1849; Schultze, Amer. Journ. Med. Sci., July, 1867, p. 258; Otto Facilides, Zeitschr. d. Œst. Apoth. Ver., 1872, No. 28; Moeller, in Proc. Amer. Pharm. Assoc., vol. xxiii (1875), p. 157, from Zeitschr. d. Œst. Apoth. Ver., No. 32 (1874), pp. 593–602; Miller, N. Rep. Ph., No. 1 (1875), pp. 1–39, and Proc. Amer. Pharm. Assoc., vol. xxiii (1875), p. 160.

DESCRIPTION OF PLATE.

The flowering specimen from a plant cultivated near Toulon in the Kew Herbarium, the fruit from a wild specimen collected by Mr. Maltass, and now in the Herbarium of the late D. Hanbury. 1. A young shoot with flowers. 2. Bract of male capitulum. 3. A male flower. 4. Section of the same. 5. Head of female flowers. 6. A branch with fruit. 7. Section of a head of fruit. 8. Full-grown leaf. (2–5 enlarged.)

C. Blanc ad nat. del. et lith.

M & N. Hanhart imp.

MELALEUCA MINOR, *Sm.*

N. Ord. Myrtaceæ. Lindl., Veg. K., p. 734; Le Maout & Dec., p. 422.

Tribe *Leptospermeæ*.

Genus **Melaleuca**,* *Linn.* B. & H., Gen., i, p. 705. Species over 100, natives of Australia, with a single (?) species widely spread through tropical Asia.

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108. Melaleuca minor, *Smith in Rees' Cyclop.*, vol. xxiii (1813).

Kayu-puti. White-wood. Cajuput.

Syn.—M. Cajuputi, *Roxb.* M. Leucadendron, var., *Benth.*

Figures.—Woodville, t. 195; Hayne, x, t. 9; Nees, t. 300 and Supp.; Trans. Med. Bot. Soc. Lond., t. 1, cop. in S. & C., t. 84, and Woodv., vol. v; Berg & Sch., t. 3 c; Rumph., Herb. Amboyn., ii, t. 17.

Description.—A rather small, irregularly growing tree, with a smooth, pale yellowish-grey, brittle bark, which splits into numerous thin layers, and slender flexuose branches. Leaves alternate or subopposite, when young very silky, when full grown rigid, tapering below into a very short petiole, blade twisted vertically, so that its edges look upwards and downwards, $2\frac{1}{2}$—4 inches long, lanceolate or ovate-lanceolate, often oblique or falcate, acute or rather blunt, quite entire, nerved with several parallel anastomosing veins. Flowers sessile, arranged usually in threes in terminal interrupted spikes about 2 or 3 inches long, with a scaly bud at the end, which grows out afterwards into a leafy branch, the rachis covered with white silky pubescence. Calyx-tube thick, about $\frac{1}{8}$ inch long, densely silky, cup-shaped; lobes 5, short, rounded, somewhat scarious. Petals 5, rounded, inserted in the mouth of the calyx, spreading, white. Stamens indefinite, filaments very slender, greatly exceeding the petals, united into 5 ribband-shaped bundles below, which are inserted in the mouth of the calyx opposite the petals, anthers small, versatile. Ovary enclosed in the calyx-tube and half inferior, convex above, with a central hollow from which the filiform style arises,

* Name from μέλας, black, and λευκὸς, white. Derivation not obvious; said to be from the different colour of the bark of the trunk and branches.

3-celled, ovules numerous, in several rows ascending from large axile placentas, stigma faintly 3-lobed. Fruit becoming woody and very hard, sessile on the sides of the branches and remaining several years, small, rounded, truncate, enclosed in the thickened calyx-tube, and crowned by its free portion, dehiscing on the summit loculicidally into three valves, 3-celled. Seeds cuneate, flattened (many abortive), testa thin, embryo with large thick cotyledons, no endosperm.

Habitat.—The tree yielding Cajuput oil grows in several of the East Indian Islands, notably in Celebes, Bouro, and Amboyna, and perhaps also in the Phillippines, Cochin China, and New Caledonia. The leaves vary somewhat in breadth and have a strong aromatic fragrance. Mr. Bentham considers it a form of *M. Leucadendron,* in which he also includes the other East Indian described species, and remarks that none of the characters supposed to separate them are sufficiently constant or so combined as to allow of their definition. As, however, it appears that it is this form only from which the oil is obtained, we have maintained the specific name, without intending thereby to express any opinion as to its distinctness from the common Australian "Tea-tree," *M. Leucadendron,* L. The plant was introduced into the Royal Gardens at Kew in 1775 and is still grown there, where, however, it does not flower.

Colebrooke, in Trans. Med. Bot. Soc. Lond., i, p. 27; Benth., Fl. Austral., iii, p. 142; Lindl., Fl. Med., p. 73.

Official Part and Name.—Oleum Cajuputi; the oil distilled from the leaves (B. P.). The oil distilled from the leaves (I. P.). Oleum Cajuputi; the volatile oil obtained from the leaves of Melaleuca Cajuputi, *Roxburgh,* (U. S. P.).

Extraction and Commerce.—Rumphius states that the leaves are gathered on a warm day and placed in a sack, where they become hot and damp. They are then macerated in water and left to ferment for a night, and afterwards submitted to distillation. Two sackfuls of the leaves yield only about three fluid drachms of the oil. Lesson, who visited Bouro, one of the Molucca Islands,

in 1823, has thus described the method there adopted for obtaining the oil :—" The leaves are gathered in the latter end of September, and put into the cucurbit of a copper alembic surmounted by a neck, terminated by a capital without a refrigeratory, and a sufficient quantity of water is then added. By distillation this liquid is made to traverse a worm immersed in a hogshead filled with water, and is collected in a vessel." Bickmore, an American traveller, who visited the same island in 1865, also states that the oil is obtained by submitting the leaves to distillation with water, the operation being conducted in the most primitive manner.

Cajuput oil is imported from Singapore and Batavia in glass beer or wine bottles. By far the largest quantity of oil is obtained from Celebes, an island on the west of Bouro in the Molucca Sea ; but some is also imported into Singapore from Java, Manilla, Bouro, and other places.

General Characters and Composition.—Oil of Cajuput or Cajeput is a transparent limpid liquid, of a pale blueish-green colour; a strong, penetrating, agreeable, camphoraceous odour ; and a warm, bitterish, aromatic, camphoraceous taste, succeeded by a sensation of coldness in the mouth. It is very volatile and inflammable. Its specific gravity has been found to vary from 0·914 to 0·930, averaging probably about 0·926 ; it boils at 343°. It is wholly soluble in alcohol. The researches of Schmidt and of Gladstone show that cajuput oil is essentially composed of *Bihydrate of Cajuputene* or *Cajuputol*. *Cajuputene* is a hydrocarbon, and possesses an agreeable odour resembling that of hyacinths.

The remarkable green colour of cajuput oil has been attributed to a salt of copper derived from the vessels in which it is distilled, but neither Brande, Gœrtner, nor Pereira could detect copper in specimens examined by them. Lesson also, who, as already mentioned, witnessed the process for obtaining the oil at Bouro, believed the green colour to be natural to it, and, moreover, Guibourt has proved that the volatile oils obtained by the distillation of the leaves of several other species of *Melaleuca* and of allied plants have naturally a fine green hue.

It is clear, therefore, that the green colour is natural to the oil, but it seems probable that this colour is lost by keeping, and that it is contaminated by copper in order to make the green colour permanent; for whatever may have been the case formerly, it is certain that traces of copper may be usually found in the cajuput oil that is now imported.

Medical Properties and Uses.—Cajuput oil is a diffusible stimulant, antispasmodic and diaphoretic when administered internally; and externally applied it is rubefacient. It is highly esteemed by the Malays and other Eastern races; but it is not much used in this country. It is, however, generally regarded as an efficacious remedy in flatulent colic, hysteria, and painful spasmodic affections of the bowels. As a diffusible stimulant it has likewise proved useful in cases marked by depression of the vital powers, as in low fevers and paralytic affections. In cholera it has been much vaunted as a remedy, but on insufficient grounds. It has also been successfully employed in chronic rheumatism, &c. Externally applied, when mixed with olive oil, it is very serviceable in chronic rheumatism, gouty affections, and in neuralgic and other painful diseases.

Per. Mat. Med., by B. & R., p. 796; Pharmacographia, p. 247; U. S. Disp., by W. & B., p. 593; Trans. Royal Soc. Edin., vol. xii, p. 360; Gmelin's Chemistry, vol. xiv, p. 514; Histed, in Pharm. Journ., vol. ii, 3rd ser., p. 804; Guibourt, Hist. des Drog., vol. iii (1869), p. 278.

DESCRIPTION OF PLATE.

Drawn from specimens in the British Museum Herbarium collected by Christopher Smith in Amboyna. 1. A small branch with leaves, buds, and flowers. 2. Vertical section of flower, the upper part of stamens removed. 3. A staminal bundle. 4. Transverse section of ovary. 5. Fruit. 6. Vertical section of the same. 7. A seed. 8. Old fruit; the growth of the terminal bud has continued the branch. (2–7 enlarged.)

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D.Blanc ad nat. del. et lith.

M.& N.Hanhart imp.

EUCALYPTUS GLOBULUS, *Labill.*

N. Ord. Myrtaceæ.

Tribe *Leptospermeæ*.

Genus **Eucalyptus**,* *L'Heritier*. B. & H., Gen., i, p. 707.
Species about 150, nearly all found in Australia.

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109. Eucalyptus Globulus,† *Labill., Voyage Rech. de La Pérouse*, i, *p.* 158 (1799).

Blue Gum-tree (Tasmania).

Figures.—Labillardière, Voy. Rech. de La Pérouse, Atlas, t. 13; F. Mueller, Plants indigenous to Colony of Victoria, Supp., t. 16.

Description.—One of the largest known trees, reaching occasionally to the gigantic height of over 300 feet, and not unfrequently to over 200 feet, and yet in some situations reduced to a dense bush. Trunk smooth, grey, the thick outer layers of the bark always easily peeling off, the young branches with 4 narrow herbaceous wings, smooth. Leaves on young plants opposite, decussate, with a short not twisted petiole, broadly ovate, with a cordate base and an acute apex, smooth, very pale, greenish-blue, almost white; on the full-grown tree alternate, with the petiole about an inch long, flattened above, and twisted half-way round, blade placed vertically with its flat surfaces lateral, 6—12 inches long, falcate, oblong-lanceolate, with a slightly tapering base, and a very much attenuated tapering apex, quite entire, smooth and shining, thick and leathery, with numerous immersed oil-glands, dull green, midrib prominent, pale, secondary veins regular, parallel, uniting with a continuous nerve which runs parallel with the margin, and at a little distance within it for the whole length. Flowers large, sessile, 2 or 3 closely crowded together, or solitary, on the expanded summit of a short, broad, much compressed, axillary peduncle; buds very glaucous, smooth, nearly half consisting of a large, thick, hemispherical, conical lid (operculum), covered

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* Name from εὖ, well, and καλυπτός, covered; in reference to the lid or operculum of the bud.

† *Globulus*, a little ball, from the button-like form of the fruit.

with irregular rounded prominences, which separates entire from the calyx-tube by a well-marked line of dehiscence at the flowering period. Calyx-tube broadly top-shaped or obconical, somewhat variable in form, more or less ribbed and worted externally, smooth, very glaucous, with numerous large globular oil-glands immersed in its substance, the edge prominent, truncate, smooth. Petals none in the expanded flower. Stamens very numerous, in several rows, inserted upon the edge of a smooth, thick, prominent, erect, green rim (disk) projecting above the line of dehiscence of the operculum; filaments long, delicate, spreading, the inner ones shorter, inflexed in the bud, cream-coloured, anthers small, ovate, with parallel cells, versatile, yellow. Ovary enclosed in the thick calyx-tube, and adherent to it throughout, flat on the top, 4- or 5-celled, with very numerous axile ovules, style short, rather thick, stigma entire. Fruit consisting of the enlarged calyx-tube and disk, which have become hard, woody, and brown, and the enclosed capsule, half-globular, the sides somewhat worted and more or less strongly 4 (or 5) ribbed, the top either nearly flat or somewhat convex, or with a very prominent central portion, nearly 1 inch wide, smooth, the rim (disk) projecting a little beyond the rest of the fruit, and separated from it by a narrow channel, capsule opening at the top by 4 (or 5) flat, hard, broadly triangular teeth. Seeds very numerous, many in each cell abortive, brown and variously shaped, but usually clavate-linear, fertile ones few, roundish-ovoid, black, about $\frac{1}{10}$ inch long, somewhat rough, not winged; embryo with large 2-lobed cotyledons folded over the straight radicle; no endosperm.

Habitat.—This very fine tree was first discovered in 1792 by the French botanist Labillardière, on the voyage in search of La Pérouse, in Van Diemen's Land, then called Cap de Diemen, and thought to be part of the Australian continent. It is abundant over the southern half of the island, *i. e.* not northwards of about sixty miles south of Launceston. Yet it grows abundantly in Flinders Island in Bass's Straits, and on the mainland of Australia is found in Victoria from Apollo Bay to Wilson's promontory, extending inland to the Buffalo range, and

ascending there into the colder altitudes. Valley-sides and the moist slopes of wooded hills are its favourite situations. It flowers in Tasmania in November and December.

The tree is now very familiar in Europe and America, and indeed throughout the world, having been of late years very extensively cultivated, especially in the Mediterranean region. Yet it was not introduced till 1856, when seeds were sent to Paris. Specimens may now be seen commonly enough in England, where, however, except perhaps in the West of Ireland and Cornwall, it cannot support the winter without shelter. Indeed, it is very sensitive to frost, and less hardy here than some other species of the genus, notwithstanding that its very restricted southern range in Australia would lead one to expect greater hardiness. It has flowered in the open air at Wexford. Throughout the south of Europe it flowers and fruits abundantly, producing ripe seed, but even there is sometimes cut off by frost. The growth of the plant is extraordinarily rapid both in height and girth of stem.

The remarkable structure to which the name of 'operculum' is given is usually considered to represent the petals, soldered together and much modified. In the present species and in many others there has been observed at an early stage a thin outer operculum, which soon falls away and is regarded as the limb of the calyx.

The fruit varies considerably; the typical button-shape is often departed from; and Baron von Mueller has described Australian varieties where it is also very much smoother and smaller than as above described.

Labillardière, Voy. La Pérouse, i, p. 151; DC., Prod., iii, p. 220; Hook. f., Fl. Tasmania, i, p. 133; F. Mueller, Fragmenta Fl. Austral., ii, p. 68; Benth., Fl. Austral., iii, p. 225.

Part Used and Name.—Eucalypti Folia; the leaves. They are not official in the British Pharmacopœia, the Pharmacopœia of India, or the Pharmacopœia of the United States.

General Characters and Composition.—The leaves, as noticed in our botanical description, vary in shape according to the age of

the tree. When used for medicinal purposes, the narrow, somewhat sickle-shaped ones, which are obtained from the full-grown tree, should alone be used, as it has been shown that these are more efficacious than the broader ovate leaves which are derived from the young plants. The fresh leaves are also more active than the dried. When fresh they have a bitterish, pungent, somewhat camphoraceous taste; and a peculiar, somewhat camphoraceous, cat-like odour, which is by no means agreeable when evolved from plants growing in a confined space.

The principal constituent of the leaves is a *volatile oil*, which may be readily obtained from them by distillation with water. This oil possesses in a marked degree the taste and peculiar odour of the leaves. When freshly distilled it has a yellow colour, but it becomes brown and resinifies by exposure to the air. According to Cloëz, it is dextrogyre; and its specific gravity as estimated by Homeyer, is 0·8762 at about 54°. Some years since Cloëz found that the principal constituent of this essential oil was a colourless liquid, boiling at 347°, and which he regarded as analogous to camphor, and to which he gave the name of *eucalyptol*. The more recent investigations of A. Faust and J. Homeyer have shown that this eucalyptol of Cloëz is a mixture of two hydrocarbons—a *terpene* and a *cymol*. They subsequently stated that the essential oil of Eucalyptus Globulus contained in addition to these two substances another terpene with a higher boiling point, and a substance containing oxygen; and in a still more recent investigation J. Homeyer has found the oil to be mainly composed of a *terpene* and *cymene*. He also obtained from it a small quantity of another terpene boiling at about 302° (the other terpene having a higher boiling point); and an oxidised substance, which the author has termed *eucalyptol*.

It was formerly imagined by some that eucalyptus leaves also contained quinia or some one or more of the other well-known alkaloids of Cinchona barks. But the experiments of Broughton the government quinologist of Ootacamund, entirely disprove this; for upon careful examination of the bark and leaves this chemist states

that neither quinia, nor any of the other alkaloids of Cinchona barks as quinidia, cinchonia, or cinchonidia, exist in the plant in any proportion. The properties of the leaves therefore, so far as is known at present, depend essentially upon the volatile oil.

Medical Properties and Uses.—So many medical practitioners have borne testimony to the febrifugal properties of the leaves—thus amongst others M. Pepin, Dr. Carlotti, Dr. Lorinser, Professor Gubler, Dr. Maclean, and Dr. Gimbert—that their value in the treatment of intermittent fever can scarcely be doubted. In Australia also, and in some other districts where the plant has been introduced, the leaves have long had a popular reputation in the treatment of fevers. Their anti-periodic properties are, however, far less manifest than those of the cinchona barks, and some of the exaggerated statements that have been made in reference to the efficiency of the leaves, appear to have arisen under the mistaken impression of their containing one or more of the alkaloids of those barks. The best form of administration, according to the opinions of the majority of practitioners, is the alcoholic tincture. Recently, Dr. Curnow has published two cases of ague successfully treated by the use of the tincture; and Dr. Fedeli, of Rome, has also lately testified to the remedial value of the various preparations of *Eucalyptus*, and especially of the alcoholic tincture, not only in cases of periodic fever and of palustral cachexia in general, but also in ailments of an atonic or anæmic character. Eucalyptus leaves have been likewise used as a stimulant and antispasmodic. The tincture and other preparations of the leaves have been also recommended for use in bronchitis; and in the form of cigarettes the leaves have been smoked, and are reputed when thus used to be efficacious in bronchitis, asthma, whooping-cough, and other diseases. An essence of eucalyptus employed in the form of an enema has also been used with success as a vermifuge. M. Gimbert has likewise recommended a new method of dressing wounds by using eucalyptus leaves instead of lint. The leaves are simply laid on the wounds; and it is said that their balsamic nature not only cures, but removes all the unpleasant

odour. It has been also stated that an excellent disinfectant may be made by adding from one to four ounces of eucalyptus oil to a bushel of deal sawdust. The experiments of Binz and Siegen prove that the antiseptic power of the eucalyptol of Cloëz is even greater than that of quinia.

When applied externally the volatile oil possesses rubefacient properties like cajuput oil, though far inferior to it. It has been used in this way in rheumatism, &c. The eucalyptol of Cloëz has also been employed for inhalation in bronchial and throat affections, one half to one teaspoonful being added to half a pint of water in the inhaler.

Besides the use of eucalyptus leaves in medicine the distilled oil of the leaves is employed together with that of several other species of Eucalyptus, as recommended by Mr. Rimmel, for diluting the more delicate essential oils; and in this way they are used for scenting soaps and other substances.

Other Products and Uses of the Eucalyptus globulus.—The bark is said to have similar properties to the leaves in the treatment of intermittent fevers, &c. It is also in use for tanning and dyeing purposes. Paper may likewise be made from this bark. This plant is also one of the many species of Eucalyptus from which exudes the very astringent substance, which from its resemblance to the official kino described under "Pterocarpus Marsupium," both in appearance and properties, is commonly designated *Australian, Botany Bay,* or *Eucalyptus Kino.* This product exudes from, and trickles down the bark of the tree in a semifluid state, but it ultimately hardens into dark red shining masses, which have a very astringent taste. It is employed for similar medicinal purposes as the official kino, and also for tanning and dyeing.

The timber of this and other species of Eucalyptus is remarkable for its solidity, hardness, and durability; and has great power in resisting the attacks of insects and the teredo, as also the influence of moisture. Moreover, this plant as recently noticed by Dr. Hooker, "seems to be proof against parasitic plants, the bark being deciduous causes the seeds of any

parasite to be dislodged before they have time to germinate and so obtain a footing in the tissues of the plant." So that in countries not too hot for its growth "its timber will probably turn out to be extremely useful." The great length of the planks that can be obtained from it is also another important element in its favour; thus, in many cases, planks of this wood have been cut of 160 feet in length, 20 inches broad, and 6 inches in thickness, and larger planks may be obtained. These qualities render the timber especially valuable for ship-building, railway sleepers, maritime works, and wherever beams of great span are required; as also for numerous other purposes.

Baron von Mueller has also shown that the ashes of the wood of this and other species of Eucalyptus contain a very large proportion of potash, in some cases as much as 21 per cent., so that this product must not be lost sight of among those obtainable from this plant.

But important as are the products obtainable from the *Eucalyptus Globulus*, it has been brought more especially into notice on account of the influence that plantations of this very rapid-growing tree are said to exert in improving miasmatic climates by destroying the paludal miasm, which causes fever in malarious districts; from which circumstance it has been called "the fever-destroying tree." The evidence that has been adduced from Australia, the native country of the tree, and from all parts of the world where it has been introduced, and which are favorable to its growth, in testimony of its anti-malarial properties, is so strong that, allowing for exaggeration in some cases, it can scarcely be doubted that this tree does produce a most beneficial effect by destroying the fever-producing miasm of marshy districts; and that it should consequently be introduced into all countries and districts where the climatic influences are favorable for its development, and where such miasmatic emanations are to be found. It has recently been planted to a large extent in Italy, and hopes are entertained "that in a few years malaria will be as effectively expelled from Italy as ague has been from Lincolnshire."

The influence of Eucalyptus trees in this respect is commonly regarded as being serviceable in two ways—first, by the far-spreading roots of this gigantic tree acting like a sponge, as it were, and thus pumping up water and draining the ground; and secondly, by emitting odorous and antiseptic emanations from its leaves. The more important influence is doubtless the power which the roots possess of absorbing water from the soil, so that when thickly planted in marshy places "the subsoil is drained in a little while as though by extensive piping;" but some influence is also exerted by the emanations from the leaves, which experiments have recently shown have marked antiseptic properties, and power of destroying the injurious effects of paludal miasm.

Gimbert, L'Eucalyptus Globulus, son importance en Agriculture, en Hygiene, et en Medicine, Paris, 1870, and Comptes Rendus, Oct. 6, 1873; Lorinser, Wiener med. Wochenschrift, vol. xix, p. 43, 1869, and vol. xx, p. 27; Gubler, Bulletin gén. de Therap., Aug. and Sept., 1871; Carlotti, L'Eucalyptus Globulus son rang parmi les Agents de la Matière Médicale, Ajaccio, 1872; Maclean, in Practitioner, Nov., 1871; Raveret-Wattel, L'Eucalyptus, Bulletin de la Société d'Acclimat., 1871–72; Bentley, Pamphlet on the Characters, Properties, and Uses of Eucalyptus Globulus, &c., and Abstract in Year Book of Pharmacy for 1874; Cloëz, Comptes Rendus, March 28, 1870; A. Faust and J. Homeyer, in Year Book of Pharmacy, 1874, p. 221, and for 1875, p. 57; Homeyer, in Journal of the Chemical Society, February, 1876; Garr., Mat. Med., p. 256; Pharmacographia, p. 174; Bosisto, in Pharm. Journ., vol. v, 3 ser., p. 270; Glover, in Pharm. Journ., vol. vi, 3 ser., p. 625, and Fedeli, vol. vi, 3 ser., p. 912; Proc. Amer. Pharm. Ass. (1875), p. 206; Curnow, in Lancet, Sept. 30, 1876; Maisch, in Amer. Journ. Pharm., 1876.

DESCRIPTION OF PLATE.

Drawn from a tree in the temperate house, Kew Gardens, flowering in May; the fruit added from von Mueller. 1. End of a flowering branch. 2. Vertical section of a flower. 3. Section of the raised disk. 4. Stamens. 5. Transverse section of ovary. 6. Fruit. 7. Transverse, and—8. Vertical section of the same. 9. A fertile seed. 10. Embryo. 11. Leaf of a young tree. (3, 4, and 7–10 enlarged.)

M & N Hanhart imp.

OLEA IMPRESSA *Wight*

N. Ord. MYRTACEÆ.

Tribe *Myrteæ*.

Genus **Pimenta**,* *Lindl.* B. & H., i, p. 717. There are 5 species, natives of tropical America.

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110. Pimenta acris, *Wight, Illust. Indian Bot.*, ii, *p.* 18 (1850).

Wild Clove. Wild Cinnamon. Bay-berry.

Syn.—Myrtus acris, *Swartz.* Myrcia acris, *DC.* Eugenia acris, *W. & A.* Amomis acris, *Berg.* A. pimentoides, *Berg.* Myrtus caryophyllata, *Jacq.* non *Linn.*

Figures.—Nees, Supp. (from a plant cultivated at Calcutta); Bot. Mag., t. 3153; Wight, Ill. Ind. Bot., ii, t. 98, fig. 6.

Description.—A tree of 30—40 feet high, with ascending branches, the smaller ones subtetragonal or quite 4-angled, often laterally compressed, smooth; bark greyish-brown. Leaves opposite, without stipules, shortly stalked, 2—3½ inches long, broadly oval or obovate-oval, rather obtuse at the apex, entire, thick, smooth, strongly veined on both surfaces, shining above, paler and covered with scattered minute dots beneath. Flowers small, numerous, stalked, arranged in threes (the central one on a short pedicel, the 2 lateral on longer widely spreading ones) at the extremities of the divaricate branches of large trichotomous axillary or terminal cymes longer than the leaves, the whole often forming one large corymbose inflorescence, branches slender, compressed, punctate with glands. Calyx-tube top-shaped, fleshy, with immersed glands, lobes 5, very shallow, very broadly triangular, thick, spreading, persistent. Petals 5, roundish, spreading, white with a tinge of red, dotted with glands. Stamens indefinite, in several rows, inserted on the outer side of the epigynous disk, filaments slender, anthers short, versatile. Ovary inferior, quite fused with the fleshy calyx-tube, 2-celled, with 1—4 ovules in each cell pendulous from the top of the inner side; style simple

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* *Pimenta*, from *Pimienta*, Spanish for Pepper; the name given to Allspice when first imported into Europe.

tapering, longer than the stamens; stigma terminal, simple. Fruit an ovoid-globular berry about the size of a pea, smooth, crowned by the persistent calyx-lobes, blackish when ripe, with scanty pulp, 2-celled. Seed solitary in each cell, structure as in *P. officinalis*, but the embryo usually less convoluted.

Habitat.—This is a tree of very great beauty and elegance of growth and the polished foliage is very fragrant. It grows in most of the West India Islands from Jamaica to Trinidad, and also occurs on the mainland of Venezuela at Caracas. It has been introduced into India where it is cultivated. In England it was grown first about 1750; there is a specimen in the Botanic gardens at Edinburgh.

The genus *Amomis*, Berg, is composed of this species (which he divides into two, *A. acris* and *A. pimentoides*), along with *A. Pimento* and *A. oblongata*; it differs from his genus *Pimenta* chiefly in its 5 petals.

A. pimentoides is regarded as a variety by most botanists; it has the leaves more obovate, and is the form cultivated in India.

Swartz, Fl. Ind. Occid., ii, p. 909; Grisebach, Fl. Br. W. Indies, p. 241; Berg, in Linnæa, xxvii (1854), p. 416; Lindl., Fl. Med., p. 76.

Official Part and Names.—Spiritus Myrciæ, *Spirit of Myrcia, Bay-rum;* the spirit obtained by distilling rum with the leaves of Myrcia acris, *Swartz* (U. S. P.). It is not official in the British Pharmacopœia or the Pharmacopœia of India.

General Description.—This official substance of the Pharmacopœia of the United States is imported from the West Indies. Its common name of Bay-rum led formerly to the belief of its being obtained by distilling rum with the leaves of the common Bay tree (*Laurus nobilis*); but its source was traced by Professor Maisch, as far back as the year 1861, to Myrcia acris, *Swartz*, the Pimenta acris, *Wight*, under which latter name it is described by us. Nothing definite is known about the manner in which Bay Rum is distilled, and of late years the larger proportion (it is said

at least three fourths) of that used in the United States, is made at home from the so-called oil of bay, which is the volatile oil distilled from the leaves of the plant now under description. But the bay rum as thus prepared is very inferior in fragrance to that which is imported, although the quality of the latter is not equal to the specimens of former years; but it can be sold at a much lower price than the genuine substance. R. Rother states, however, that the following formula yields a product which possesses a much stronger aroma than the imported article, and is in other respects equally satisfactory:

Take of—

Oil of Bayberry	1 fluid ounce.
Jamaica Rum	1 pint.
Strong Alcohol	4 pints.
Water	3 pints.

Mix the rum, alcohol, and water, then add the oil; mix and filter. The measures are those of the United States Pharmacopœia. Of course none of these imitations of the imported bay rum are official.

The *oil of bay*, or as it is better termed *oil of bayberry*, has been described by Maisch as a limpid brownish-yellow liquid, with a pungent spicy taste, and an aromatic odour like that of allspice. It is lighter than water, partially soluble in alcohol, and freely soluble in ether. Its composition has not been thoroughly ascertained, but according to R. Rother, it is a mixture of a terpene and an acid; and the same experimenter also states "that eugenic acid, which is common to the oils of pimento and cloves, is also the chief ingredient of oil of bay, and that the difference in the odour and taste of the oils of cloves, pimento, and bayberry is determined by the characteristic terpenes."

Medical Properties and Uses.—Bay rum is chiefly employed in the United States as a refreshing perfume in faintness, nervous headache, and other nervous affections. It may be either applied to the head, or held to the nostrils. It is also an agreeable and refreshing substance to sprinkle about the rooms of the sick and convalescent.

Bay rum is also employed by the perfumer in the preparation of hair-washes, and for other purposes.

The dried unripe fruit also forms a substitute for the official pimento or allspice.

U. S. Disp., by W. & B., p. 835; Maisch, in Amer. Journ. Pharm., July, 1861; Proc. Amer. Pharm. Assoc. (1873), p. 436, and for 1876, p. 97; Chicago Pharmacist, May, 1876, and Brit. Pharm. Journ., ser. 3, vol. vi, p. 968; Pharmacographia, p. 257.

DESCRIPTION OF PLATE.

Drawn from a specimen in the British Museum collected in Dominica by Capt. Findlay.

1. A branch with fruit.
2. Flower and buds.
3. A flower.
4. Calyx and pistil.
5. A petal.
6. Vertical section through the flower; the petals removed.
7. Transverse section of ovary.

(3–7 enlarged.)

PIMENTA OFFICINALIS, *Lindl.*

N. Ord. MYRTACEÆ.

Tribe *Myrteæ*.

Genus Pimenta, *Lindl.*

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111. Pimenta officinalis, *Lindley, Collectanea Bot., sub* t. 19 (1821).

Pimento. Allspice. Jamaica Pepper.

Syn.—Myrtus Pimenta, *Linn.* Eugenia Pimenta, *DC.* P. vulgaris, *Wight & Arn.*

Figures.—Woodville, t. 294; Hayne, x, t. 37; Bot. Mag., t. 1236, cop. in Steph. & Ch., t. 124; Nees, t. 298; Tussac, Fl. Antilles, iv, t. 12; Wight, Ill. Ind. Bot., ii, t. 98, fig. 7.

Description.—A tree 30 feet high, with a slender trunk, branched above; bark very smooth, grey, young branches somewhat flattened, quadrangular, glabrous. Leaves opposite, stalked, 4—6 inches long, oval-oblong, somewhat tapering into the petiole, blunt and often somewhat emarginate at the apex, entire, smooth on both surfaces, deep green, paler and minutely gland-dotted beneath, with the midrib prominent. Flowers small, arranged much as in *P. acris*, but the central flower of each three sessile; the corymbose cymes scarcely exceeding the leaves. Calyx-tube ovoid, fleshy, with immersed glands, the upper part prolonged a little above the ovary; segments 4, rounded, fleshy, spreading, persistent. Petals 4, rounded, spreading or reflexed, thick, concave, deciduous, white. Stamens indefinite, inserted in the epigynous throat of the calyx, erect. Ovary as in the last species. Fruit a globose berry, about as large as a pea, crowned by the persistent calyx-lobes, within which, in a small pit, is the persistent style, 2-celled. Seeds one in each cell, somewhat compressed, subreniform; testa thin and membranous, embryo spirally coiled or convolute, with a long thick radicle and very short cotyledons; no endosperm.

Habitat.—The Pimento tree grows wild in most of the West Indies, and is common in Jamaica, where it occurs especially near

the coast, prefering a limestone soil. It is also found in Central America—Mexico and Costa Rica—and in Venezuela. As an introduced plant, it is now cultivated in India and other tropical countries. It was grown in our stoves before 1732, and flowers very well. The flowers are sweet-smelling, and produced in June to August; occasionally the female organs are but partially developed, and the flowers, therefore, barren. The leaves are completely evergreen.

This is the only species of *Pimenta* in Berg's restricted sense; he describes 5 varieties, the characters of which are taken from slight differences in the form of the leaves. It is readily distinguished from the last species by the number of divisions to the calyx.

Grisebach, Fl. Brit. W. Indies, p. 240; Lunan, Hort. Jamaicensis, ii, p. 66; Berg, in Linnæa, xxvii, p. 422; Lindl., Fl. Med., p. 76.

Official Parts and Names.—1. PIMENTA; the dried unripe berries of the Allspice tree, Eugenia Pimenta, *DC.*: 2. OLEUM PIMENTÆ; the oil distilled in Britain from Pimento (B. P.). The dried unripe berries (I. P.). The unripe berries (U. S. P.).

1. PIMENTA, PIMENTO, OR ALLSPICE.—*Collection, Preparation, and Commerce.*—When the fruit has attained its full size, but while yet green, the small twigs which bear it arranged in bunches are broken off the trees; these are then spread out and the berries dried by exposure to the air and sun for several days; the stalks are then separated and the fruit afterwards put into bags and casks for exportation. When the fruit is allowed to ripen it loses its aromatic warmth, and is said to acquire a taste like juniper berries; hence the cause of its being gathered in an unripe state. Pimento is obtained entirely from Jamaica, where the trees are extensively cultivated in regular plantations called *Pimento Walks.* In the year 1871, the exports of this spice amounted to nearly 7,000,000 lbs., representing a money value of about £29,000. By far the larger proportion was forwarded to Great Britain and the United States, thus, to the former

4,287,551 lbs., and to the latter country 2,266,950 lbs. The average exports of late years have amounted to 50,000 cwts.

General Characters and Composition.—*Pimento,* or as it is more commonly termed *Allspice,* or sometimes *Jamaica Pepper,* is a small, dry, light, roundish fruit, which varies somewhat in diameter, but is on an average about the size of a small pea. It is crowned with the remains of the calyx in the form commonly of a slightly elevated scar-like ring; and rarely at the other extremity of the fruit there is a short stalk attached. Pimento consists of a brittle, somewhat woody shell or pericarp, which has a dark brown colour externally, and is more or less rough on its surface from the presence of small receptacles of oil; and of two dark, brownish-black, somewhat compressed, kidney-shaped seeds, each of which is contained in a separate cell. Pimento has an agreeable, warm, spicy taste, much resembling that of cloves; and an aromatic agreeable odour, which is thought to resemble that of a mixture of cinnamon, cloves, and nutmegs, hence the name of allspice which is commonly applied to it. The aromatic properties are more evident in the shell than in the seed.

The principal constituent of pimento, and the one to which its properties are essentially due, is a *volatile oil*; this is described below. Pimento also contains a little *fixed oil,* which is stated to have an acrid, burning, aromatic taste, and which is also said to contribute to its activity, but the nature of this oil is by no means well ascertained. Some *starch;* a large quantity of *tannic acid;* other unimportant constituents; and according to Dragendorff, a very minute quantity of an alkaloid, are also to be found in pimento.

2. Oleum Pimentæ, *Oil of Pimento.*—This oil, which is obtained by the distillation of pimento with water, is contained in the proportion, according to different experimenters, of from about 3·20 to 4·6 per cent. This oil is lævogyrate; colourless or slightly yellowish-red when freshly distilled, but becoming brown by age; its sp. gr., according to Gladstone, is 1·037; its odour and taste are similar to those of the spice. Its composition, as shown by the experiments of Oeser, and confirmed by Gladstone, is essentially

the same as that of oil of cloves. Thus it consists of a hydrocarbon which is lighter than water, and is termed *light oil of Pimento,* and of an oxygenated oil, which forms crystallizable salts with alkalies, and which is identical with the *caryophyllic* or *eugenic acid* of cloves.

Medical Properties and Uses.—Both pimento and the oil possess aromatic, carminative, and stimulant properties. The action of pimento is similar to that of cloves, and it may therefore be employed for the same purposes; thus to relieve flatulence, check vomiting, and as an adjunct to other medicines to cover their nauseous taste, and to prevent griping, &c.

The oil of pimento may be also employed for the same purposes as oil of cloves. Thus it may be used to relieve toothache, and to correct the operation of other medicines, as purgatives and tonics.

The principal consumption of pimento is, however, not as a medicine, but as a culinary spice. Oil of Pimento is also used by the perfumer.

The pimento tree also furnishes walking sticks and umbrella handles which are in great request.

Per. Mat. Med., vol. ii, pt. 2, p. 235; Per. Mat. Med., by B. & R., p. 800; Pharmacographia, p. 256; U. S. Disp., by W. & B., pp. 674 and 1311; Piesse, Art of Perfumery, p. 128; Brown, Nat. Hist. of Jamaica, p. 248; Technologist, vol. vi, p. 427; Pharm. Journ., ser. 2, vol. vii, p. 616.

DESCRIPTION OF PLATE.

Drawn from a specimen collected by Dr. Wright in Jamaica, in the British Museum.

1. A branch with fruit.
2. Flowers.
3. A single flower.
4. Vertical section through flower.
5. A petal.
6. Transverse section of ovary.
7. A fruit.
8, 9. Seeds.
10. Seed with its testa.
11. Embryo.

(3–6, 10, 11 enlarged.)

M.&N. Hanssart imp.

N. Ord. Myrtaceæ.

Tribe *Myrteæ*.

Genus Eugenia,* *Linn.* B. & H., i, p. 718 (includes *Jambosa*, *Syzygium*, &c.). One of the largest genera, containing over 700 species, natives principally of tropical and sub-tropical America and Asia.

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112. Eugenia caryophyllata,† *Thunberg, Diss. de Caryoph. aromat., p.* 1 (1788).

Clove.

Syn. — Caryophyllus aromaticus, *Linn.* Eugenia aromatica, *Willd.* Myrtus Caryophyllus, *Spreng.*

Figures.—Woodville, t. 193; Hayne, x, t. 38; Steph. & Ch., t. 95; Nees, t. 299; Berg & Sch., t. 3 d; Bot. Mag., tt. 2749, 2750.

Description.—A tree reaching 30 or 40 feet high, with numerous slender horizontal branches forming a dense pyramidal crown; bark pale yellowish-grey, smooth, buds glabrous. Leaves opposite, numerous, evergreen, 3—6 inches long including the petioles which are ¾—1 inch long, oval, acute or acuminate at the apex, tapering into the petiole at the base, entire, smooth on both sides, thick, dotted with minute glands, dark green and shining above, paler beneath with the midrib and parallel lateral veins prominent. Flowers jointed to short stalks, arranged in threes at the extremities of the short articulated branches of small terminal paniculate cymes; bracts small, soon deciduous. Calyx about ½ inch long, inferior, glabrous, somewhat rough with numerous immersed glands, whitish at first, then green, and finally crimson, the lower part cylindrical-compressed, oblong, solid, fleshy, the upper part cut into 4 short, triangular, fleshy, concave, spreading teeth. Petals 4, strongly imbricated in the bud so as to form a little spherical head embraced by the calyx-teeth, quickly falling, very concave, rounded, about ¼ inch

* Given by Micheli in 1729 in honour of Prince Eugene (see his 'Nova Genera,' p. 227). The species was *E. uniflora*, Linn.

† *Caryophyllon*, καρυόφυλλον, was the classical name of a sweet-scented spice, probably cloves.

wide, beset with immersed oil-glands, yellowish. Stamens very numerous, inserted in several rows on the outside of an elevated, quadrilateral, epigynous disk; filaments about as long as petals, and spreading after the fall of the latter; anthers small, versatile, dehiscing longitudinally, roundish. Ovary completely immersed in the summit of the fleshy calyx, small, 2-celled, with numerous axile ovules; style simple, shorter than the stamens, slender, tapering. Fruit fleshy, about 1 inch long, obovoid-oblong, crowned by the persistent inflexed calyx-teeth and the style, smooth, purple, pericarp about $\frac{1}{8}$ inch thick. Seed solitary (all the other ovules becoming abortive), large, occupying the whole interior of the fruit; testa membranous, thin; embryo straight, covered with minute glandular dots, cotyledons large, often unequal, fleshy, irregular, enclosing the long cylindrical radicle, which projects at the summit; no endosperm.

Habitat. — This beautiful and aromatic evergreen tree is supposed to have been originally indigenous to the true Moluccas or Clove Islands, five islets lying off the coast of the larger island of Dilolo, north-east of Celebes. In these it is no longer to be found, having been intentionally destroyed there, but it is largely cultivated in the neighbouring islands of the Amboyna group into which it is believed to have been introduced before the commencement of the 16th century. The clove is also now cultivated in Sumatra and Malacca, Penang (where it was first grown about 1798, having been introduced by Christopher Smith), the islands of Mauritius and Bourbon (into which it was brought in 1770), Guiana, Brazil, most of the West Indian Islands, and Zanzibar, and, in fact, is spread through the tropical world. The first plant seen in this country was brought to Kew by Sir Joseph Banks in 1797. The flowers are sweet-scented and abundantly produced.

The monstrosity which was formerly called the royal clove, "caryophyllum regium," is rarely produced. It was at one time believed that a single tree only existed in the island of Ternate, which was religiously preserved by the king for his own use. This is figured in Rumphius's 'Herb. Amboinense,' ii, t. 2, and,

from specimens in the British Museum, clearly results from the production of additional fleshy, pointed, persistent bracts, decussately arranged below the more or less abortive bud.

Linnæus' genus *Caryophyllus* is now generally reduced to *Eugenia*. The chief difference lies in the remarkable solid stalk-like lower portion of the calyx (*hypanthium*), which is not found in any other *Eugenia*.

The petals in the clove are not combined to form an actual calyptra as in *Eucalyptus*, but show an approach to the condition obtaining in that genus (see *E. Globulus*, no. 109), and are readily detached in one mass from the bud.

DC. Prod., iii, p. 262; Berg in Linnæa, 1854, p. 137; Grisebach, Fl. Br. West Indies, p. 235; Lindley, Fl. Med., p. 75; Flück. and Hanb., Pharmacogr., p. 249.

Official Parts and Names.—1. Caryophyllum; the dried unexpanded flower-buds of Caryophyllus aromaticus, *Linn.*: 2. Oleum Caryophylli; the oil distilled in Britain from Cloves (B. P.). The dried unexpanded flower-bud (I. P.). Caryophyllus; the unexpanded flowers (U. S. P.).

1. Caryophyllum, Caryophyllus, or Cloves.—*Collection and Preparation.*—The manner of collecting cloves and preparing them for the market varies somewhat in different localities. Thus in the islands of Zanzibar and Pemba on the Eastern Coast of Africa, the flower-buds (cloves) are gathered as soon as they have lost their green colour and become red. Each clove is then picked singly by hand, a moveable stage of sufficient height to enable the labourers to reach the upper branches of the tree being employed for that purpose. The cloves are then dried by exposure in the sun, by which they acquire without further preparation their ordinary brown colour. In the Moluccas the cloves are either collected by hand, or separated from the trees by long bamboos so as to fall on cloths placed beneath them; after which, as a general rule, they are simply dried in the sun, or sometimes by artificial heat. At Bencoolen the cloves are always picked singly by hand, and dried in the sun. In this locality the clove

tree begins to yield at the age of six years, and at that of twelve is in its highest state of bearing, after which the yield diminishes till the tree reaches about the age of twenty years, when it usually perishes. In the Moluccas there are two clove harvests in the year, namely, in June and December. The average annual produce of a good clove tree may be estimated at about five pounds, but the quantity varies a good deal in different years and in different localities.

General Characters, Varieties, Commerce, and Composition.— The clove of commerce is the dried unexpanded flower. It consists of the long, tapering, cylindrical or somewhat angular, tube of the calyx; surmounted at the top by its four teeth, between which the four petals enclosing the numerous stamens and style are closely imbricated in the form of a ball or sphere— the whole somewhat resembling a nail in form, hence the name *clove*, from the French *clou*. Cloves are usually rather more than half an inch in length; their colour is a deep brown, that of the corolla being somewhat lighter; their surface has a dull, wrinkled appearance; and when they are slightly pressed or scraped with the nail a small quantity of oil exudes from them. They have a strong, fragrant, spicy odour; and a very pungent, aromatic taste.

There are several commercial varieties of cloves, which are distinguished by the name of their place of growth, as they do not exhibit any essential structural differences. The best cloves are large, plump, heavy, of a dark brown colour, and exude oil on being pressed with the nail. Inferior kinds are smaller, paler coloured, light in weight, more or less shrivelled, and from being less rich in essential oil they have a feebler smell and taste. In the London market the varieties known as Penang, Bencoolen, Amboyna, and Zanzibar, are the best; they are arranged in the order of their value. The Cloves from Cayenne and the West Indies are of inferior value. Of late years the islands of Zanzibar and Pemba have been the largest clove-producing localities, thus up to the year 1872 the crop in a single season at these islands had reached 10½ millions of pounds. But since

this period, in consequence of the almost entire destruction of the clove trees in Zanzibar by a very violent hurricane, the supply has very much diminished, but it is now gradually recovering its former importance. In 1871-72 the quantity of Zanzibar cloves imported into this country indirectly from Bombay, amounted to 3279 cwt. A large exportation of cloves also takes place direct from Zanzibar to the United States and elsewhere.

The principal constituent of cloves, and the one to which their properties are essentially due, is the *volatile oil*, which is described below. They also contain a neutral, tasteless, inodorous substance, termed *caryophyllin*, which crystallizes in needle-shaped prisms, and is isomeric with laurel camphor; another tasteless crystalline body called *eugenin;* a considerable proportion of *gum;* a kind of *tannic acid;* some *salicylic acid*, and other unimportant constituents.

2. Oleum Caryophylli, *Oil of Cloves.—Extraction, General Characters, and Composition.*—This oil is obtained by distilling cloves with water, but in order completely to exhaust them, the water should be repeatedly distilled from the same cloves. Common salt is sometimes added to the water in which cloves are distilled for the purpose of raising the temperature of ebullition, and superheated steam has also been advantageously employed in the distillation of this oil. Cloves are remarkable for the large quantity of oil they yield; thus the produce of good cloves is about one sixth or one fifth of their weight—that is, from about 17 to 20 per cent. The oil was formerly generally imported, but the best oil is now distilled in Britain, and is so directed to be obtained in the British Pharmacopœia.

Oil of Cloves is colourless or pale yellow when recent, but it becomes gradually reddish brown by keeping from a resinous change in eugenic acid, one of its constituents; it has in a high degree the odour and taste of cloves. It is one of the least volatile of the essential oils; its sp. grav. has been variously estimated from 1·034 to 1·061, hence it sinks in water; it has no rotatory power. It is a mixture of a hydrocarbon, and an

oxygenated oil in variable proportions. The former, which is lighter than water, is called *light oil of cloves;* it is colourless, and has the same composition as oil of turpentine. The latter is termed *eugenol, heavy oil of cloves,* or from its forming crystallizable salts with acids, *eugenic* or *caryophyllic acid;* it is colourless at first, but becomes coloured by age; it has a spec. gr. of 1·068, and the full taste and odour of cloves.

Medical Properties and Uses.—Both cloves and the oil are stimulant, aromatic, and carminative. They are, however, rarely employed alone, but generally as an adjunct to other medicines to improve their flavour, or to correct their operation by checking nausea and griping. Cloves in substance or infusion are, however, sometimes given to relieve nausea and vomiting, more especially the vomiting of pregnancy, to relieve flatulence, and to excite weak digestion. The oil of cloves sometimes affords relief when introduced into the cavity of a carious tooth.

The chief consumption of cloves is as a culinary spice. The oil of cloves is also extensively used by soapmakers, and in the preparation of perfumes; and also by the distiller.

3. Other Products of the Clove Tree.—The flower stalks are sometimes employed as a spice instead of cloves. They are commonly known as *Clove Stalks,* and by the French as *Griffes de Girofle;* they are principally exported from Zanzibar, where they are termed by the natives *vikunia.* Clove stalks possess the odour and taste of cloves, though in a less degree; and only yield from 4 to 5 per cent. of volatile oil. They are principally used for adulterating ground or powdered cloves.

Under the name of *Mother Cloves* (*Anthophylli*), the dried fruits of the clove tree are also sometimes found in commerce. They vary from about three quarters to an inch in length, are somewhat oval in form, and are crowned at the top with the four teeth of the adherent calyx, with the remains of the style in the centre. They resemble ordinary cloves in colour, taste, and smell, but in the latter respects they are much weaker. They contain far less oil than cloves, hence they are very inferior to them as a spice. They might be used in a powdered state like clove stalks to adulterate ground or

powdered cloves; but as they contain large starch granules, which are absent from ordinary cloves, such an admixture would be readily detected by the microscope.

Clove leaves were also formerly in use to some extent, but they are not now seen in commerce.

Steph. & Church., Med. Bot., by Burnett, vol. ii, pl. 95; Per. Mat. Med., by B. & R., p. 798; Pharmacographia, p. 250; U. S. Disp., by W. & B., pp. 231 and 1304; Crawford, Dict. of the Indian Islands, 1856, article Clove; Watts' Dict. Chem., vol. i, pp. 809 and 1029; Piesse, Art of Perfumery, p. 79; Pharm. Journ., vol. x, ser. i, p. 343, also vol. xi, ser. i, pp. 470 and 520, and vol. i, ser. ii, p. 183.

DESCRIPTION OF PLATE.

Drawn from specimens in the British Museum collected at Amboyna by Christopher Smith.

1. A flowering branch.
2. A flower-bud.
3. Vertical section of flower after fall of the petals.
4. Anthers.
5. Transverse section through the ovary.
6. A fruit.
7. Embryo.
8. The same with one cotyledon removed.
9. Transverse section of fruit.

(2–5 enlarged.)

N. Ord. LYTHRACEÆ.

Tribe *Granateæ*. Le Maout & Dec., p. 435 (*N. Ord.*).

Genus Punica,* *Linn.* B. & H., Gen., i, p. 784. There is but a single species.

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113. Punica Granatum,† *Linn., Sp. Plant., ed.* 1, *p.* 472 (1753).

Pomegranate.

Figures.—Woodville, t. 190; Hayne, x, t. 35; Steph. & Ch., t. 57; Nees, t. 301 (double fls.); Berg & Sch., t. 3 a, b; Wight, Illust. Ind. Bot., t. 97; Fl. Græca, t. 476; Bot. Mag., t. 1832; Fl. Brasil., fasc. 18, t. 8, 9 (evolution of flowers).

Description.—A bush or small tree 10—15 feet high, with straight, slender, somewhat angular branches, often with spiny ends, bark pale brownish-grey, furrowed longitudinally; the young shoots and buds red. Leaves usually opposite, sometimes alternate, often fascicled on the older branches, shortly stalked, without stipules, 1—2 inches long, oblong-ovate or lanceolate, tapering at both ends, quite entire, rather thick and stiff, perfectly smooth and shining, often persistent (half-evergreen). Flowers large, solitary or 2 or 3 together in the axils of the leaves near the end of the branches, very shortly stalked. Calyx large, broadly tubular, over $1\frac{1}{4}$ inch long, thick and leathery, adherent to the ovary below, cut into 5—7 thick, triangular, acute, valvate lobes above, smooth, shining, scarlet. Petals 5—7, inserted in the throat of the calyx and alternating with its lobes, spreading, imbricate, crumpled, roundish, with a short broad claw crimson. Stamens very numerous, free, inserted in several rows on the calyx-tube below the petals, crowded, erect; anthers ovoid, dorsifixed, 2-celled, introrse, yellow, dehiscing longitudinally. Ovary completely amalgamated with the lower part of the calyx-tube, thick and leathery, with two tiers of cells, the lower tier of 3 cells, the

* *Malus punica* (the Lybian or Carthaginean apple) was the Latin name of the tree; the Greeks called it ῥοιά.

† *Granatum* was also a classical name for the plant; from the numerous seeds (*grana*).

upper of 5—8 cells, ovules very numerous, sessile, covering the whole surface of the placentas which in the cells of the lower tier are axile, and in those of the upper tier parietal; style tapering; stigma simple, capitate. Fruit as large as an orange, 2½—3 inches or more in diameter, hard, depressed-globose, bluntly 5—8 angled over the position of the dissepiments, abruptly contracted at the top into a short neck terminated by the thick persistent calyx-lobes and containing the withered stamens; pericarp thin, nearly smooth, tough, yellow or reddish, cavity irregularly divided below the middle into two stories by a thin, somewhat conical diaphragm extending from the centre to the sides, upper story divided into 5—8 irregular cells by thin, tough membranous dissepiments, lower story often also with one or more vertical partitions. Seeds very numerous, entirely filling the fruit, attached in the upper cells on all sides of thick, strong, spongy placentas, which project from the wall, but do not extend to the top or bottom of the cells, and in the lower cell or cells either all over the floor of the fruit or on several irregular projecting placentas; each seed elongated, about ½ an inch long, variously polygonal from pressure, chiefly composed of a thick, translucent, pink, juicy coating, inner coat hard, white; embryo straight, radicle very short, cotyledons foliaceous, convolute; no endosperm.

Habitat.—As in the case of other plants cultivated from remote antiquity the native country of the Pomegranate is somewhat uncertain. It is, however, generally considered native in North Western India, Southern Persia, and perhaps Palestine, and to have been introduced at a distant period into the Mediterranean countries of Europe and Northern Africa, in which latter district, as its name indicates, it was once considered indigenous: it was also brought to China in very ancient times from Western Asia. At the present day this tree is spread over all the warmer and temperate countries of the globe; and in this country, into which it was introduced before the middle of the 16th century, it is much cultivated as an ornamental shrub for the sake of its very handsome flowers which are abundantly produced from June to

September. Fruit is also sometimes formed here, but it has very little flavour. The flowers are frequently double in gardens. A dwarf form, *P. nana*, Linn., with narrower leaves, is also cultivated, especially in the West Indies.

The structure of the ovary and fruit of the Pomegranate is quite anomalous, and thus the genus has no close allies. Many authors place it in *Myrtaceæ*, others make it an Order of itself; the authors of the "Genera Plantarum" place it (with a few others) as an anomalous genus at the end of the *Lythraceæ*.

DC. Prod., iii, p. 3; Boissier, Fl. Orient., ii, p. 736; Roxburgh, Fl. Ind., ii, 499; Lowe, Man. Fl. Madeira, i, p. 262; Lindl., Fl. Med., p. 74.

Official Parts and Names.—Granati Radicis Cortex; the dried bark of the root (B. P.). 1. The root-bark (*Granati Radicis Cortex*) : 2. The dried rind or pericarp of the fruit (*Granati Cortex*) (I. P.). 1. Granati Radicis Cortex; the bark of the root : 2. Granati Fructûs Cortex; the rind of the fruit (U. S. P.).

1. Granati Radicis Cortex. *Pomegranate Root Bark.—General Characters, Commerce, and Composition.*—Pomegranate Root Bark as found in a dried state in commerce, is in quills or fragments, which are commonly three or four inches in length. It has a yellowish-grey colour externally; and its surface is wrinkled, or marked with faint longitudinal striæ, or furrowed from corky bands, which in the thickest pieces form broad flat exfoliating scales. Its inner surface is smooth or nearly so, of a yellow colour, and it has portions of the pale coloured wood frequently adhering to it. It breaks with a short fracture; has little or no odour; but a marked astringent, and very feebly bitter taste. For use in this country it is commonly obtained from the south of Europe; and is more especially collected in the south of France and in Italy.

The principal constituent of the bark is *tannic acid*, of which it contains about 22 per cent., and which, according to Rembold, is essentially a peculiar variety, and has been termed *punico-tannic acid*. Other constituents are *gallic acid* in small proportion, and

a large amount of *mannite*. An acrid uncrystallizable principle called *punicin* has also been indicated as a constituent by Righini; but some recent observers believe that this is only mannite. An infusion of the bark yields a deep blackish-blue precipitate with the solution of a persalt of iron; and its inner surface when moistened with water, and rubbed on paper, leaves a yellow stain, which, by the contact of sulphate of iron, becomes deep blue.

Adulterations and Substitutions.—Box bark and barberry bark are said to be sometimes substituted for, or mixed with, pomegranate root bark; but they may be readily distinguished from it by their infusions not being affected by the persalts of iron like that of pomegranate root bark. They have also an evident bitter taste which is not the case with pomegranate root bark.

The bark of the stem or branches is also frequently mixed with, or substituted for, the root bark; this may be readily distinguished by its less corky character. The stem bark is commonly regarded as less active than that of the root; but we have no record of experiments proving this.

Medical Properties and Uses.—The root bark has been occasionally used from a very early period as a vermifuge, for among other ancient writers, Celsus, Dioscorides, and Pliny, all refer to its value in this respect; but it was unknown in modern practice till it was again recommended for use by Drs. Buchanan, Anderson, Fleming, and others. Waring says it is very effectual for the destruction of tapeworm, and for this purpose he recommends the official decoction to be taken fasting; and to be followed by an aperient. The fresh root bark is used in India, and is commonly preferred; but Dr. De Vrij and others say that all real root bark, fresh or dried, and wherever collected, is efficacious. In this country the extract of male fern is generally regarded as a more efficacious remedy for the expulsion of tapeworm than pomegranate root bark. The bark is also sometimes used in chronic diarrhœa and dysentery.

2. Granati Cortex, or Granati Fructûs Cortex. *Pomegranate Rind.—General Characters and Composition.*—The dried rind is in irregular, more or less arched, hard, brittle fragments, some of

which have projecting from them the tubular calyx with the remains of the stamens and style enclosed. It is somewhat rough externally, and of a yellowish- or reddish-brown colour; internally it is pale yellow or brownish, and marked with depressions left by the seeds. It has no marked odour; but a very astringent and feebly bitter taste.

Like the root bark its principal constituent is *tannic acid*, of which it contains nearly 19 per cent.; hence its infusion produces a deep blue precipitate on the addition of a persalt of iron. Other constituents are *sugar*, and a little *gum*.

Medical Properties and Uses.—Pomegranate rind may be employed both externally and internally wherever astringents are indicated, but in this country its use is almost obsolete. It is, however, highly esteemed as a remedy for diarrhœa and chronic dysentery in India, where it is commonly combined with opium.

In those countries where the pomegranate tree is common, the rind has been employed in tanning leather.

3. Other Products of the Pomegranate Tree.—The ripe fruit is much esteemed in the East; and in this country it is frequently used at dessert. It may be also eaten as a slightly astringent and refreshing refrigerant in some febrile affections, especially those of the bilious type. In the East the juice of the fruit is much used in the preparation of cooling drinks. The seeds, leaves, and flowers of the pomegranate tree also possess astringent properties, and were employed by the ancients. The flowers are still used in the East, and were formerly official in the Dublin Pharmacopœia. They are termed *Balaustine flowers* or *Balaustines;* they have a fine red colour, and a slightly astringent taste; but no odour. They communicate a violet-red colour to the saliva. Their principal constituent is *tannic acid*. By the ancients they were employed in dyeing, as well as medicinally, for their astringent properties.

Per. Mat. Med., vol. ii, pt. 2, p. 241; Per. Mat. Med., by B. & R., p. 803; Pharmacographia, pp. 258–260; U. S. Disp., by W. & B., p. 438; Celsus de Medicina, lib. 4, cap. 17; Pharm. of India, p. 93; Year-Book of Pharmacy for 1874, p. 504; Journ.

de Pharm., 3e ser., vol. v, p. 298; Buchanan, in Edinb. Med. and Surg. Journ., vol. iii, p. 22; Debeaux, Pharmacie et Mat. Med. des Chinois, p. 70; Med.-Chir. Trans., vol. xi, p. 301.

DESCRIPTION OF PLATE.

Drawn from a plant in Chelsea Garden; the fruit added.

1. A branch with flowers.
2. Vertical section of flower, the petals removed.
3. Anthers.
4. Transverse section through upper tier of cells of ovary
5. Fruit.
6. Transverse section through upper story of the same.
7. Seeds as seen on a vertical section of fruit.
8. Transverse and--9. Vertical section of a seed deprived of the juicy covering.

(3, 4, 8, 9, enlarged.)

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N. Ord. CUCURBITACEÆ. Lindl., Veg. Kingd., p. 311. Le Maout & Dec., p. 449.

Tribe *Cucumerineæ*.

Genus Citrullus,* *Schrad.* B. & H., Gen., i, p. 826. There are 2 or 3 species, natives of the Mediterranean, Africa, and W. Asia.

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114. Citrullus Colocynthis,† *Schrader in Linnæa* xii, *p.* 414 (1838).

Colocynth.

Syn.—Cucumis Colocynthis, *Linn.*

Figures.—Woodville, t. 71; Steph. & Ch., t. 138 (bad); Nees, t. 268; Berg & Sch., t. 256; Wight, Ic. Plant. Ind. Or., t. 498.

Description.—A perennial herb, with a large, long, woody, branched, yellow root, with a broad crown, whence arise several long, slender, tough, angular, branched, greyish, prostrate stems, very rough with numerous short scabrous hairs. Leaves alternate, on long hispid petioles which are about as long as the slender, slightly branched, lateral tendril, blade triangular in outline, very variable in size, 1—4 inches long, usually deeply and subpalmately cleft into broad, blunt, rounded, sinuated segments, which are again slightly lobed and undulated, the margin often involute, very rough with short blister-like prickles on both surfaces especially beneath, pale green, greyish beneath. Flowers rather large, unisexual, monœcious, on long, rough peduncles, solitary in the axils of the leaves. Male flowers:—Calyx campanulate, hairy externally, cut into 5 narrow, acute lobes; corolla gamopetalous, cup-shaped, confluent with the calyx-tube below, divided more than half way down into 5 obtuse segments, downy externally, pale yellow, veined; stamens 3, inserted in the tube of the corolla, filaments short, glabrous, anthers with the connective expanded and flattened, elongated; one 1-celled, two 2-celled,

* *Citrullus*, the name of the mediæval pharmacists for *C. vulgaris*, Schrad.; apparently from the citron-like colour of the fruit.

† *Colocynthis*, κολοκυνθίς, the classical name of the plant.

pistil quite rudimentary or absent. Female flowers :—Calyx-tube fused with the ovary, above which it is strongly contracted, otherwise as in the male ; stamens represented by three small abortive staminodes ; ovary inferior, globular-ovoid, hairy, fleshy, 1-celled, with 3 large fleshy parietal placentas projecting to the centre and the cavity filled up then recurved, with numerous horizontal ovules; style short; stigma sessile, with three lobes. Fruit globose, $2\frac{1}{2}$—$3\frac{1}{2}$ inches in diameter, smooth, sometimes with faint longitudinal furrows, greenish, mottled, 1-celled, the pericarp hard but thin, the interior completely filled with soft, spongy, watery tissue, in the outer part of which are immersed the numerous seeds closely crowded on the recurved borders of the large placentas, so that a section has a somewhat 6-celled appearance. Seeds about $\frac{1}{3}$ inch long, obovate-oval, compressed, with obtuse margins, smooth, dark or pale brown, marked at the hilar end on each side with two short furrows ; embryo with leafy, plane-convex cotyledons and a short radicle ; no endosperm.

Habitat.—This is a common desert plant and has a wide range, growing in the most barren and arid situations. It extends from North West India, throughout Arabia and Syria to Egypt, where it is very abundant, some of the Greek Islands, Northern Africa to Morocco, and the Cape Verd Islands. It also grows in Senegal, at the Cape of Good Hope, and Japan. In Europe it occurs wild in a few spots on the sea shore of Spain and Sicily, and has been introduced to similar localities in Southern France. It has been cultivated in Cyprus for several centuries. The plant is grown in the Botanic Gardens at Edinburgh and at Kew ; it is mentioned so long ago as in 1551, by Turner, as cultivated in gardens in England.

C. vulgaris, Schrad. (*Cucumis Citrullus,* L.), the "Water-Melon" so commonly cultivated throughout the East and the Mediterranean regions of Africa and Europe, is very closely allied to the Colocynth, from which it differs in its annual duration, its larger, nearly smooth leaves, and its larger fleshy fruit, filled with a yellowish or red edible pulp, usually devoid of all bitterness. It is no doubt a native originally of Tropical Africa, but was an

object of culture even by the ancient Egyptians. It is figured in Nees, tt. 71 and 72, and is an exceedingly variable plant. The pulp, though usually edible and sweet, is sometimes bitter (*C. amarus*, Schrad.)

Boissier, Fl. Orient., ii, p. 759; Hook. f., in Fl. Trop. Africa, ii, p. 548; Harvey and Sonder, Fl. Capensis, ii, p. 494; Naudin, in Ann. des Sciences Nat., 4, xii, p. 99; Lindl., Fl. Med., p. 84; DC. Géogr. Bot., p. 908; Pappe, Flor. Cap. Med. Prod., p. 14.

Official Part and Names.—Colocynthidis Pulpa; the dried decorticated fruit, freed from seeds (B. P.). The dried decorticated fruit, freed from seeds (I. P.). Colocynthis; the fruit, deprived of its rind (U. S. P.).

Collection and Preparation.—Colocynth fruit is gathered in the autumn; it is then usually peeled and dried quickly in a stove; or, in some cases, more slowly, by exposure to the sun. It is rarely dried in an unpeeled state.

General Characters and Varieties.—As usually found in the market, the fruit is peeled; it then forms whitish balls, consisting of the pulp in which the seeds are imbedded, and which constitute about three fourths of its weight. These balls, which are generally more or less broken, are very light in weight, roundish, somewhat angular on their surface, spongy, tough, nearly inodorous, but with an intensely bitter taste. The seeds are commonly brown coloured, or sometimes they are yellowish white; they have no odour, but a feebly bitter taste, more especially the brown-coloured ones. The pulp divested of the seeds is alone official. The broken-up pulp freed from seeds is the condition in which it is usually supplied to pharmacists, under the name of *Colocynth pulp* or *pith*.

Two varieties of colocynth have been distinguished by pharmacologists under the names of *Turkey* or *Peeled Colocynth*, and *Mogador* or *Unpeeled Colocynth*. Turkey colocynth is chiefly imported from Spain and Syria in a peeled state, as its common name implies, and has the characters just described; but sometimes it is imported simply dried, that is, without having been peeled, in

D.Blair ad nat. del. et lith.

M&N.Hanhart imp.

ECBALLIUM ELATERIUM. *A. Rich.*

N. Ord. CUCURBITACEÆ.

Tribe *Cucumerineæ*.

Genus **Ecballium**,* *Rich.* B. & H., Gen., i, p. 826. The following is the only species.

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115. Ecballium Elaterium,† *A. Rich., Dict. Class. d'Hist. Nat.*, vi, *p.* 19 (1825).

Squirting Cucumber. Wild Cucumber.

Syn.—Momordica Elaterium, *Linn.* Ecbalium agreste, *Reichenb.* Ecballium officinale, *N. & E.* Elaterium cordifolium, *Moench.*

Figures.—Woodville, t. 72; Hayne, viii, t. 45; Steph. & Ch., i, t. 34; Nees, t. 272; Bot. Mag., t. 1914; Flor. Græca, t. 939; Reich., Ic. Fl. Germ., xix, t. 1619.

Description.—A small perennial herb, with a fleshy, tapering, white root. Stems prostrate or trailing, ½ to 3 feet long, branched, thick, succulent and translucent, cylindrical, slightly furrowed, set with scattered short, thick, stiff, projecting hairs or bristles. Leaves alternate, without stipules or tendrils, on very long, thick, succulent, tapering petioles, hispid with bristles like those of the stem; blade 3—5 inches long, bluntly triangular in outline, deeply cordate with square or rounded auricles at the base, blunt at the apex, coarsely and irregularly toothed or lobed and undulated at the margin, pale green and with few scattered tubercled hairs above, more or less white with dense woolly hairs beneath. Flowers unisexual, monœcious, rather large, stalked, the male flowers usually several together on a common axillary peduncle, the female usually solitary, occasionally accompanying the male flowers. Calyx deeply divided into 5 narrow, acute segments, hispid with long white bristly hairs, in the male flowers with a very short tube, in the female superior, the tube fused with the ovary. Corolla gamopetalous, with a very short tube and 5 widely

* Name from ἐκβάλλω, to throw out, from the action of the fruit. Richard spells it *Ecbalium*, but the above must be more correct.

† From ἐλατήριον, purging, the name of the drug in classical times.

spreading, equal, ovate-oblong, acute segments, slightly hairy inside, sulphur-yellow veined with pale green. Male flowers:—Stamens 3, inserted on the base of the corolla, filaments short, hairy, anthers with an expanded, flattened and crumpled connective, one 1-celled, the others 2-celled, the cells elongated, placed along the edge of the dilated connective; no pistil. Female flowers:—Stamens absent or represented by 3 sterile filaments; ovary inferior, ovoid, fleshy, 1-celled, with 3 large fleshy parietal placentas filling up this cavity (and making it look 3-celled), with numerous stalked horizontal ovules in a row along either side; styles 3, somewhat connected below, green, bifid above, and with a large papillose stigma on the outer side of the branches. Fruit pendulous or nodding from the recurved tip of the elongated, gradually tapering, slightly hispid, succulent stalk, oblong-ovoid, rounded at the base, more acute at the apex where it is capped by the withered flower, $1\frac{1}{2}$ to $2\frac{1}{4}$ inches long, fleshy, firm, pale yellowish-green, covered with short, pale, succulent papillæ terminating in hair-like points, pericarp thick, white within, filled with a watery juice in which the seeds are immersed, when ripe separating from the stalk suddenly, and violently expelling the juice and seeds through the orifice thus formed; after this phenomenon the fruit becomes narrower and hollow, the cavity being lined with soft green pulp. Seeds numerous, closely packed, but loose in the watery pulp, oblong-ovoid, slightly compressed and keeled, smooth and polished, bright pale brown, testa thin, brittle, with a thin layer of soft tissue externally, inner coat very thin and membranous; embryo large, white, cotyledons plane-convex, radicle at the hilum, short, broad, pointed; no endosperm.

Habitat.—A common weed in waste places in the South of Europe, throughout the Mediterranean district and reaching as far to the east as Persia. It was very early cultivated in gardens in this country (before 1568), and is now grown in small quantity for use at Mitcham and Hitchin.

The singular mode of expelling the seeds (from which the plant has its name) is explained by the engorgement of the central pulp of the fruit by fluid which passes into it by osmosis from the

outer part of the pericarp through its contractile inner portion; the resulting tension at length becomes so great that the wall gives way at the point of least resistance, which is where the fruit is united to its stalk. The seeds are thrown out with great force and to a considerable distance.

If placed in water the outer covering of the seeds swells up into a large mass of semi-transparent jelly; the structure of the superficial cells which undergo this change is described and figured by Du Tailly in the paper quoted below.

Gren. & Godr., i, p. 604; Boiss., Fl. Orient., ii, p. 760; Lindl., Fl. Med., p. 86; Du Tailly, in Adansonia, x, p. 208, t. 8, 9.

Official Parts and Names.—1. Ecbalii Fructus; the fruit, very nearly ripe, of the Squirting Cucumber, Ecbalium officinarum, *Richard:* 2. Elaterium; a sediment from the juice of the Squirting Cucumber (B. P.). The sediment from the expressed juice of the fruit (*Elaterium*) (I. P.). Elaterium; a substance deposited by the juice of the fruit of Momordica Elaterium (U. S. P.).

1. Ecbalii Fructus.—The fruit is directed in the British Pharmacopœia to be obtained when very nearly ripe, because if left till it is quite ripe, it separates spontaneously from its peduncle, and at the same time the seeds and juice are expelled with violence from the aperture left by the detached stalk; it is from this circumstance that its common name of Squirting Cucumber is derived. It is advisable, therefore, that the stalk should be attached to the fruit when it is used; otherwise the pericarp may have burst and expelled the contained juice.

2. Elaterium.—*Preparation.* Dr Clutterbuck proved many years since, that the active substance—elaterium—is principally contained in the juice around the seeds, the remainder of the fruit being comparatively inert. As this juice is more liquid than any other part of the fruit it alone runs out to any extent, when the fruits are simply sliced, and therefore Dr. Clutterbuck's experiments have shown that the finest elaterium is obtained without pressure from the fruits when as nearly ripe as possible.

But in practice some pressure must be employed; because the fruits must not be too ripe when gathered, otherwise they are apt to burst either at that time or when carried away; and in this imperfectly ripe state the juice does not readily flow from them until lightly pressed. The process ordered for the preparation of Elaterium in the British Pharmacopœia is founded upon these principles, and is as follows:—"Cut the fruit lengthwise, and lightly press out the juice. Strain it through a hair sieve; and set it aside to deposit. Carefully pour off the supernatant liquor; pour the sediment on a linen filter; and dry it on porous tiles with a gentle heat. The decanted fluid may deposit a second portion of sediment, which can be dried in the same way." The amount of elaterium obtained will vary very much according to the mode of preparation. Thus, by operating on the fruits without pressure, forty cucumbers, as the fruits are commonly termed, only yielded Dr Clutterbuck six grains of elaterium; but by using slight pressure, the average quantity of elaterium obtainable is about half an ounce from a bushel or forty pounds of the fruits. If greater pressure be employed a larger quantity may be obtained, but the product is deteriorated in quality in proportion to the amount of force used in expressing the juice. It seems, however, certain that in very warm dry seasons the produce is larger than just mentioned, for in the very fine summer of 1868, 240 lbs. of fruits gathered at Mitcham, according to Hanbury, yielded $4\frac{5}{8}$ ounces of elaterium = 0·123 per cent.

No directions are given for the preparation of elaterium in the United States Pharmacopœia, the plant not being, at present, cultivated to any extent in that country, hence the official elaterium is understood to be that found in commerce, and which is principally obtained from England, although to some extent also, of late years, from Malta.

General Characters, Varieties, and Composition.—Elaterium when of good quality occurs in light, friable, opaque, flat or very slightly curved cakes, about $\frac{1}{10}$ of an inch thick; these are frequently marked on one of their surfaces by the impression of the paper, linen, or muslin, on which they were dried. Elaterium has a pale green

colour when fresh, but by keeping it becomes greyish-green, and ultimately of a yellowish-grey or drab colour. Some pieces, after being kept for years, acquire a sparkling appearance externally, from the presence of very minute crystals. Elaterium has a finely granular fracture; an acrid and bitter taste; and a faint tea-like odour. It does not effervesce with acids; a cooled decoction is not perceptibly affected, or but very slightly so, by the addition of a solution of iodine; it yields half its weight to boiling rectified spirit, and this solution concentrated and added to warm solution of potash, yields on cooling not less than twenty per cent. of colourless crystals of elaterine, its acitve principle. Inferior kinds of elaterium are usually darker coloured, harder, more curled, and break with difficulty or with a close resinous fracture. The above remarks especially apply to English Elaterium, but this drug is also imported from Malta, and is then known in commerce as *Maltese Elaterium*. This kind is commonly in larger flakes or cakes, and of a paler colour than that prepared in England. It is also frequently mixed with starch or chalk, or with both these substances; hence such specimens either effervesce with dilute hydrochloric acid, or a cooled decoction becomes blue with solution of iodine, or both these reactions may take place, neither of which, as already seen, occur with the best English Elaterium. As a general rule, Maltese elaterium is inferior to English, although it may be occasionally found of good quality.

The active constituent of elaterium is *elaterine* or *elaterin* (the *ecbalin* of Williams). This is best obtained, according to Flückiger and Hanbury, by exhausting the drug with chloroform, and adding ether to the solution when it forms a crystalline deposit of elaterine, which should be purified by further washing with a little ether and recrystallizing from chloroform. In this way they obtained 33·6 per cent. of elaterine from the best English Elaterium and 27·6 from the Maltese kind. Good commercial elaterium ordinarily yields from 20 to 30 per cent. of elaterine. Elaterine crystallizes in colourless hexagonal scales or prisms; it is readily soluble in chloroform or boiling alcohol, and is insoluble in water

or ether; its alcoholic solutions are neutral; and it has an extremely bitter and slightly acrid taste. The experiments of Williams prove that when the fruits are exhausted of the free juice from which elaterium is obtained, they contain little if any elaterine; and Köhler found that the percentage of elaterine, even in the free juice of the fruits, gradually diminished as the season advanced, so that in September he was unable to obtain any amount of it whatever. It has also been clearly demonstrated that hot dry weather is favorable to the development of elaterine, and hence elaterium is most powerful when produced in very fine summers. From these circumstances therefore, as well as from its different modes of preparation already noticed, we have frequent causes which produce the varying strength of the drug. According to Walz, elaterium also contains a second crystallizable bitter principle, and three amorphous substances. The first principle he found to be a glucoside, to which he gave the name of *prophetin*: the others require further examination.

Medical Properties and Uses.—Elaterium is the most powerful hydragogue cathartic that is known, for when prepared by Clutterbuck, without pressure from the fruits, it purged violently in doses of one eighth of a grain; the usual dose of good commercial elaterium is from $\frac{1}{16}$ to $\frac{1}{2}$ a grain. Considering the varying strength of elaterium from season, climate, time, and mode of preparation, it would be desirable to substitute for it, or at least to introduce into use, its active and definite principle elaterine. The dose of elaterine could easily be regulated by mixing it previously with sugar of milk; or a solution of definite strength might be ordered in the pharmacopœia. Elaterium is a valuable remedy in dropsical affections, more especially when connected with disease of the heart. It is also a valuable remedy in renal dropsy. In cerebral affections, such as apoplexy, elaterium is also sometimes useful to relieve plethora and to prevent further effusion. Elaterium should be cautiously administered, as it sometimes causes nausea and great depression; and in improper doses it may produce violent gastro-enteritis and even death. When locally applied, elaterium acts as an irritant, as is proved by

the inflammation and ulceration of the fingers it sometimes produces in those employed in its preparation. The juice of the fruits has also produced violent inflammation in some cases by getting accidentally into the eyes of those engaged in their collection.

Per. Mat. Med., vol. ii, pt. 2, p. 219; Per. Mat. Med., by B. & R., p. 792; Pharmacographia, p. 260; U. S. Disp., by W. & B., p. 372; Gmelin's Chemistry, vol. xvii (1866), p. 365; Waring's Man. Pract. Therap., p. 299; Bell, in Pharm. Journ., vol. x, 1st ser., p. 168; Bentley, in Pharm. Journ., vol. i, 2nd ser., p. 323; Williams, in Chem. News, Feb. 18, 1860, p. 124; Power, in Amer. Journ. Pharm., Jan., 1875, p. 1, and in Pharm. Journ., vol. v, 3rd ser., p. 645.

DESCRIPTION OF PLATE.

Drawn from a plant in Kew Gardens, flowering in August.

1. End of a flowering stem.
2. A male flower.
3. Section of the same.
4. Anthers.
5. Section of a female flower.
6. Stigmas.
7. Section of the ovary.
8. Fruit.
9, 10. Seed.
11. Section of the same.

(4, 6, 10, 11 enlarged.)

CUCURBITA PEPO. *Linn.*

N. Ord. CUCURBITACEÆ.

Tribe *Cucumerineæ*.

Genus **Cucurbita**,* *Linn.* B. & H., Gen., i, p. 828. Species about 6, natives of tropical and warm regions.

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116. Cucurbita Pepo,† *Linn., Sp. Plant., ed.* 1, *p.* 1010 (1753).

Pumpkin. White Gourd.

Syn.—C. maxima, *Duchesne.* C. polymorpha, *Duch.* C. ovifera, *Linn.* C. verrucosa, *Linn.* C. moschata, *Duch.*

Figures.—Berg, Characterist., t. xxv, fig. 205 (fruit and seed); Schnitzlein, Iconograph., t. 202 (details); Ann. des Sc. Nat., ser. 4, vi, tt. 1—3 (fruit); Wight, Ic. Fl. Ind. Or., t. 507 (*C. moschata*).

Description.—A very large annual herb, with a prostrate spreading stem reaching 30 or 40 feet in length, stout, tough, becoming woody below, angular, pale green, thickly set with coarse, harsh, more or less bristly hairs, slightly branched. Leaves numerous, alternate, on long hispid striated petioles, large, sometimes a foot in diameter, broadly cordate-ovate, more or less deeply 5-lobed, the lobes either obtuse, rounded, or acute, entire or toothed, dark green, often mottled with white, very hispid on both surfaces; tendrils long, slender, unbranched or palmate. Flowers unisexual, monœcious, very large, axillary, usually solitary, long-stalked. Male flower :—Calyx with a shallow funnel-shaped tube fused with the corolla, and 5 distant, erect, linear-setaceous, dark green, bristly segments; corolla very large, 3—5 inches in diameter, cup-shaped, gradually narrowed to the base, divided about half way down into 5 broad acute recurved lobes, strongly veined, pubescent outside, very finely so or glabrous within, orange yellow; stamens 3, together forming a central erect column, filaments broad, smooth, anthers completely combined into an oblong, blunt head about $\frac{3}{4}$ inch long, the cells sinuous. Female flower :—Calyx-tube shallower than in the male, the seg-

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* *Cucurbita*, the classical Latin name for a gourd.

† *Pepo*, in Greek πέπων, another name for a gourd or melon.

ments longer and broader; corolla usually somewhat larger than in the male, more veined, the throat nearly or quite closed by a smooth, fleshy, swollen, irregularly 5-lobed crown, surrounded by a membranous ring (abortive stamens?). Ovary completely inferior, immediately beneath the flower, ovoid, more or less pubescent, 1-celled (apparently 3-celled), with 3 parietal placentas which occupy the whole interior and bear the numerous ovules on their reflexed edges, styles 3, thick, combined below into a short column, free above and terminating in 3 distinct, recurved, ovate-oblong, bilobed, thick, very papillose, orange-coloured stigmas. Fruit very large, 1—2 feet in diameter, very variable in form, but typically depressed-spherical with the vertical axis much shorter than the diameter, the upper and under surfaces being concave, grooved with numerous, shallow, longitudinal furrows, smooth, greenish or pale dull yellow, pericarp thin, tough, lined with a thick layer of orange-coloured fleshy pulp, 1-celled, with a large cavity in the centre. Seeds very numerous, about $\frac{7}{8}$ inch in length, oblong-oval, blunt at both ends, much compressed, surrounded by a thick, blunt, rounded border, smooth but not shining, pale greyish yellow, embryo large, occupying the whole seed, cotyledons obtuse, veiny, no endosperm.

Habitat.—The countless varieties of cultivated Gourds and Pumpkins may have originated from one or from several wild ancestors; they are now usually arranged under several species. In spite of the careful researches of Naudin, there remains much uncertainty as to the distinctions and relationships of the various forms; and the complete absence of good figures, and the rarity of specimens in our herbaria, add to the difficulty. They are, therefore, here combined.

No form of *Cucurbita Pepo* is known in a wild state, and we are guided only by other evidence to the conclusion that the country of their origin is probably some part of Asia. In Asiatic countries they have been objects of cultivation from remote antiquity, and their introduction to the Mediterranean districts must have been in very early times. They have now spread over all the globe.

The particular form here figured is *C. maxima*, Duch. It

includes the true pumpkins, and is distinguished by its very large globular depressed fruit, supported on a thick corky clavate stalk, which is not ribbed or deeply grooved. Many varieties are in cultivation; that mostly grown in England is smooth and yellow ochre in colour, in another form the pericarp is finely mottled all over, and a curious smaller sort is remarkable for the crown of separate carpels which project at the top, and give the name of Turk's cap or Turban to the fruit.

The name *C. Pepo* is, by the best authorities, as Naudin and Cogniaux, restricted to a more coarse and prickly plant with sharp-lobed cup- or funnel-shaped leaves, the corolla constricted at the base, and a very deeply-grooved, woody fruit-stalk. This presents much variety in the form of the fruit, but it is usually oblong or ovoid; the familiar "vegetable marrow" comes under this variety. According to Lowe, by far the best gourd in Madeira is produced by *C. moschata*, Duch., the Musk Melon, which has spotted leaves, spathulate or foliaceous calyx-segments, and drab-coloured seeds, and the fruit very smooth, dark green or orange, and covered with a white "bloom."

Of these 3 species or varieties, Alefeld enumerates respectively 31, 66, and 8 forms.

Naudin, in Ann. Sc. Nat., ser. 4, xii, p. 84; Lowe, Fl. Madeira, i, p. 284; Cogniaux, Fl. Brasil., fasc. 78, p. 22; DC., Géogr. Bot., p. 900; C. B. Clarke, in Fl. Brit. India, ii, p. 622.

Official Part and Names.—Pepo; the seed of Cucurbita Pepo (U. S. P.). It is not official in the British Pharmacopœia, or the Pharmacopœia of India. It is commonly known as *Pumpkin Seed.*

General Characters and Composition.—Pumpkin seeds vary somewhat in form, but are always more or less oval; they are commonly about three quarters of an inch in length, and half an inch broad; their colour is light brownish-white; their taste sweetish and agreeable; and they have a very feeble, somewhat aromatic odour. They consist of a firm brittle integument, and a whitish oily nucleus.

Pumpkin seeds were found by Dorner and Wolkowitsch, in

1870, to contain *resin, fixed oil, sugar, albumen, colouring matter, starch,* trace of *volatile oil,* and a peculiar crystalline body, which they supposed to be a glucoside, and named *Cucurbitin.* More recently, Nicolai Kopylow also found resin, sugar, colouring matter, trace of volatile oil, 44·50 per cent. of fixed oil, and 32·75 per cent. of starch; but no alkaloid, nor could the presence of cucurbitin be established by him. He also ascertained that the fixed oil consisted of the glycerides of palmitic, myristic, and oleic acids; and that the oil extracted by ether also contained free fatty acids. This oil is readily obtained from the seeds by expression; it is a clear, transparent liquid, of a light brownish-green colour, a slightly oily odour, and a bland taste, like that of oil of almonds. The physiological experiments of Heckel indicate that the anthelmintic properties of pumpkin seed essentially reside in the membrane immediately surrounding the embryo; and upon examination he found this contained a large proportion of resin, which he therefore regards as the active constituent. Vigier, however, states that the seeds lose none of their activity when deprived altogether of their integuments. It is difficult to reconcile these conflicting results, except on the supposition that the seeds of different species or varieties of *Cucurbita* were used by the two chemists; further experiments are therefore necessary. It is also desirable that the seeds of plants grown in different countries should be submitted to chemical examination, as those obtained from hot countries have been commonly found more active than those derived from plants of cold latitudes.

Medical Properties and Uses.—Pumpkin seeds have long been reputed to possess anthelmintic properties, more especially in cases of tænia; but whether they destroy the worm, or simply expel it from the system, does not appear to have been definitely ascertained. The value of these seeds as an effectual remedy for tapeworm now rests, however, upon the evidence of so many practitioners in different parts of the world, that it can scarcely be doubted that we have in them a trustworthy anthelmintic. But, as already mentioned, much difference of opinion exists as to the comparative merits of different parts of the seed, as well as of

the seeds of different countries. Stillé directs their administration as follows:—From one to two ounces of pumpkin seeds, as fresh as possible, should be deprived of their outer envelope and beaten to a paste with finely-powdered sugar, and diluted with water, or milk, when taken; and in order to secure its successful operation no food should be taken for twenty-four hours before. Three or four hours afterwards one or two tablespoonfuls of castor oil should be administered. The expressed oil of the seeds, in doses of half an ounce, repeated once or twice at an interval of two hours, and followed in two hours more by a dose of castor oil, is said to be equally effectual. In other cases, the seeds have been given entire in similar doses, and then either eaten by themselves, or beaten up into a paste with sugar and water.

The seeds of *Cucurbita maxima* seem to have similar properties; indeed, those of the two plants appear to have been indifferently used in different countries. From recent trials in Italy, and in this country, "the tapeworm was found to be expelled entire a few hours after the administration of the remedy, and not piecemeal and wanting the head, as is often the case when *Filix mas* is employed." The seeds of *C. maxima* from different districts are said to vary much in activity. Thus the seeds of plants growing in San Remo are described as most active, while those obtained in places adjacent to San Remo were valueless.

Merat & Lens., Dict. Mat. Med., vol. ii, p. 493; U. S. Disp., by W. & B., p. 661; Stillé, Therap. and Mat. Med., vol. ii, p. 625; Pharmacopœia of India, p. 96; Dunglison's New Remedies, p. 717; Annuaire de Therap. (1852), p. 301, and 1862, p. 176; Pharm. Journ., ser. 2, vol. vii, p. 418, and ser. 3, vol. vi. p. 308, from the Lancet; Proc. Amer. Pharm. Assoc. for 1877, vol. xxv, p. 199; Chemist and Druggist, vol. xx, p. 339; Pharm. Journ., ser. 3, vol. ix, p. 637.

DESCRIPTION OF PLATE.

Drawn from cultivated specimens in the herbarium of the British Museum. 1. A leaf and male flower. 2. Vertical section of lower part of female flower. 3. Transverse section of ovary. 4. A seed. 5. Vertical, and—6. Transverse section of the same. 7. A branch with flowers and fruit; very much reduced. (3 and 6 enlarged.)

HYDROCOTYLE ASIATICA Linn.

N. Ord. UMBELLIFERÆ, Lindl., Veg. King., p. 773; Le Maout and Dec., p. 465.

Tribe *Hydrocotyleæ*.

Genus Hydrocotyle,* *Linn.* B. & H., Gen., i, p. 872. Species over 70, natives of warm and temperate regions in both worlds, especially in the southern hemisphere.

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117. Hydrocotyle asiatica, *Linn., Sp. Plant., ed.* 1, *p.* 234 (1753).

Indian Pennywort.

Syn.—H. nummularioides, *Rich.* H. pallida, *DC.*, &c.

Figures.—Rheede, Hort. Malab., x, t. 46; Rumph., Herb. Amboin., v, t. 169; Wight, Ic. Plant. Ind. Or., ii, 565; Refugium Botan., t. 202.

Description.—A perennial herb, with a vertical rootstock, giving off very long, slender, prostrate, smooth, cylindrical branches, with very long internodes, rooting at the nodes, and producing there tufts of leaves and flowers. Leaves crowded together at the nodes, stalks very long, erect, dilated and sheathing at the base, hairy when young, afterwards nearly smooth, blade reniform or roundish reniform, ½—2 inches wide, more or less shallowly dentate-crenate, with rather large crenatures, rather thick, radiate-veined, glabrous on both surfaces, dark green. Flowers very small, nearly sessile, placed 3 (rarely 4) together at the ends of slender peduncles arising from the axils of the leaves and much shorter than their petioles, supported below by an involucre of two boat-shaped, membranous, persistent bracts. Calyx-tube united closely with the ovary, the limb represented by a slight rim without teeth. Petals 5, broadly ovate, acute, entire, dark pink, distant, valvate in bud. Stamens 5, alternating with the petals, and with them inserted just within the calyx-rim (epigynous), filaments very short, flattened; anthers rounded. Ovary inferior, rounded-compressed, smooth, 2-celled, with a single pendulous ovule in each cell, the top covered by an epigynous disk, which is nearly flat; styles 2, short, subulate, persistent.

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* *Hydrocotyle*, from ὕδωρ, water, and κοτύλη, a cup, from the place of growth and the form of the leaves of the common European species, *H. vulgaris*.

Fruit small, about $\frac{1}{8}$ inch wide and less in length, much laterally compressed, readily separating into 2 indehiscent halves (mericarps), united by a very narrow plane of junction (commissure), smooth, without definite primary or secondary ribs, but veined with prominent vertical nerves, which slightly anastomose, rounded on the back, the inner wall thick, white and hard, without vittæ. Seed solitary in each mericarp, pendulous, embryo small, imbedded in the top of the abundant endosperm.

Habitat.—This little creeping and inconspicuous plant is found in shady places, especially where damp or swampy, throughout the tropical regions of both the old and new worlds, extending also into the warmer non-tropical regions, as the Cape, New Zealand, and Chili. In India it is very common throughout the Peninsula, flowering in October. The foliage varies a good deal both in size, shape, and amount of crenation. The plant has been cultivated here in a few botanic gardens.

The inflorescence of *Hydrocotyle* is rather a few-flowered capitulum than even a very simple umbel; in the æstivation of the petals and the structure of the fruit also, the genus is unlike the rest of the Umbelliferæ included in this book.

Roxb., Fl. Indica, ii, p. 88; Harvey, Fl. Capensis, ii, p. 527; Bentham, Fl. Australiensis, iii, p. 346; Pappe, Fl. Cap. Med. Prodr., p. 17.

Official Part and Name.—Hydrocotyles Folia; the leaves (I. P.). They are not official in the British Pharmacopœia, or the Pharmacopœia of the United States.

Preparation.—In the Pharmacopœia of India the freshly gathered leaves are directed to be freed from their stalks, and dried thoroughly by exposure in the open air in the shade at a moderate temperature, and when dry reduced to fine powder, and placed in well-stoppered bottles. It is stated that thirty pounds of the fresh leaves prepared in this manner yield between three and four pounds of the powder. Solar and a high artificial heat are objectionable, as they are said to cause the dissipation of the oily principle, on which the activity of the leaves depend.

Although the leaves are alone official in the Pharmacopœia of India, the whole plant possesses similar properties to them, and Boileau says that the entire plant is preferable to the leaves only.

General Characters and Composition.—The fresh leaves when entire have little or no smell, except when bruised, when they exhale a peculiar aromatic odour; but they have a disagreeable, bitter, and pungent taste. These qualities appear to be lost in a great measure by drying; but the powder, which is of a pale green colour, is said to have a slight but pleasant aroma.

An analysis of hydrocotyle has been made by Lépine, who discovered in it a peculiar principle which he called *vellarine*, a term derived from *vallarai*, the Tamil name of the plant, and in which he supposed its active properties to reside; he obtained it from the dried plant in the proportion of 0·8 to 1 per cent. *Vellarine* is an oily liquid, of a pale colour, soluble in alcohol, ether, and caustic ammonia, with the strong odour of the bruised fresh leaves, and having a disagreeably bitter pungent taste. The authors of Pharmacographia also describe *tannic acid* as one of the constituents of hydrocotyle.

Medical Properties and Uses.—It is regarded as an alterative tonic when given internally; and stimulant when applied externally. In these respects its powers seem to be well established. It is also stated by Ainslie, on the authority of Dr. Horsfield, that in Java it has the reputation of being an excellent diuretic. M. Cazenave, of Paris, also states that "its most remarkable and constant effects are a considerable increase of the urinary secretion, increased heat of the skin, and production of copious perspiration." As a remedial agent it attracted much attention some years since, from the very satisfactory results obtained from its use by Dr. Boileau, of the island of Mauritius, under the name of *Bevilacqua*, in the treatment of leprosy. It was afterwards tried by M. Lépine, of Pondicherry, who also reported very favorably of its value in leprosy. Subsequent trials by Drs. Hunter, Waring, and others, have shown that although it possesses no claim to the character of a specific in leprosy, yet that the benefits derived from it are so well

marked that it is entitled to be regarded as an efficacious remedy. Waring says that in some cases of Anæsthetic Leprosy the improvement was both rapid and decided; but that its effects in Tubercular Leprosy were not nearly so evident. The same physician says, that besides its beneficial effects in leprosy, it is a remedy of great value "in secondary and constitutional syphilis, especially in those cases where the skin and subjacent cellular tissue are principally affected." Besides being administered internally it is sometimes locally applied, either in the form of a poultice made of the fresh leaves, or by sprinkling the powder on ulcerated surfaces.

Pharmacopœia of India, pp. 107 & 448; Pharmacographia, p. 265; U. S. Disp., by W. & B., p. 1611; Ainslie, Mat. Med., vol. ii, p. 473; Bouton, Med. Plants of Mauritius, 1857, p. 73; Journ. de Pharm., July, 1855, p. 49; Hunter, in Madras Med. Reports, 1855, p. 356; Pharm. Journ., vol. xvii, ser. 1, p. 312; Waring, in Pharm. Journ., vol. ii, ser. 2, p. 142; Indian Annals of Med. Sci., 1858, vol. v, p. 597.

DESCRIPTION OF PLATE.

Drawn from a specimen in the British Museum, collected by Horsfield in Java.

1. Portion of a plant with flowers and fruit.
2. An umbel.
3. A single flower.
4. A petal.
5. A stamen.
6. Pistil.
7. A cluster of fruit.
8. A single fruit.
9. Transverse section of the same.

(2–9 enlarged.*)

* In the figures of the *Umbelliferæ*, the enlarged figures of the fruit are uniformly magnified 4 diameters, and the sections 8 diameters.

CONIUM MACULATUM, *Linn.*

M & N Hanhart imp.

N. Ord. UMBELLIFERÆ.

Tribe *Ammineæ*.

Genus Conium,* *Linn.* B. & H., Gen., i, p. 883; Baill., Hist. Pl., vii, p. 229. Species 2 or 3, natives of the northern hemisphere of the old world.

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118. Conium maculatum, *Linn., Sp. Plant., ed.* 1, *p.* 243 (1753).

Hemlock.

Syn.—Cicuta maculata, *Lam.*, non *Linn.*

Figures.—Woodville, t. 42; Hayne, i, t. 31; Nees, t. 282; Steph. & Ch., t. 13; Berg & Sch., t. 24 e; Curt., Fl. Londin., fasc. 1; Syme, E. Bot., iv, t. 629 (bad); Baill., Hist. Plantes, vii, figs. 145-7; Bigelow, i, t. 11.

Description.—A biennial herb, 3—6 feet, or even more, in height, with a long, forked, pale yellow root ½—¾ inch in diameter. Stem erect, stout below, much and corymbosely branched above, hollow, striate, perfectly smooth, bright green mottled with small irregular stains or spots of a port-wine colour and covered with a white "bloom" which is very easily rubbed off. Leaves numerous, those of the first year and the lower ones very large, even reaching 2 feet in length, alternate, long-stalked, deltoid in outline, tripinnate, the upper ones much smaller, nearly sessile, with the short petiole dilated and stem-clasping, often opposite or three together, more oblong in outline, bipinnate or pinnate, all flaccid, quite glabrous, uniform dull deep green, the ultimate divisions lanceolate-oblong, deeply pinnatisect, with toothed segments, each tooth tipped with a minute, sharp, white point. Umbels rather small, 1¼—2 inches broad, numerous, terminal, on rather short peduncles, flat-topped, rays 12—16, straight, general involucre of 4—8 lanceolate, acuminate, deflexed bracts, narrowly bordered with white, partial involucre of 3 or 4 small spreading bractlets on the outer side of the umbellule; flowers small, the outer ones rather larger, the inner ones often barren, pedicels &c. often

* *Conium*, formed by Linnæus from the classical Greek name for the plant, κωνείον; the *Cicuta* of the Romans.

with a minute scurfy covering. Calyx-teeth absent, but the ovary with a thick ring round the top. Petals nearly equal, obovate, with an inflexed point. Stamens a little longer than petals; anthers white. Ovary with the primary ridges very strongly marked, and bearing a row of translucent papillæ, giving a crenated appearance; styles short; epigynous disk flattened, white. Fruit small, about $\frac{1}{8}$ inch long, broadly ovate, slightly compressed laterally, crowned by the dry stylopod and slender, spreading styles, quite smooth, dull greenish grey; mericarps readily separating, primary ridges prominent, equal, blunt, becoming thin and wing-like when dry, more or less crenated, the two lateral ones marginal; vittæ none, but the furrows at first occupied by numerous, very slender, irregular channels. Seed with a very deep narrow furrow down the commissural surface.

Habitat.—The true Hemlock is by no means an uncommon plant in this country, but is somewhat inconstant in its appearance. It is found on hedgebanks, waste ground, and the borders of water in nearly every part of England, but is thought to be doubtfully wild in the north of Scotland. Throughout Europe, except the extreme north, it is found in similar places, and its range extends into temperate Asia and North Africa and the Canary Islands. It has also been introduced into the United States and South America. From our other native Umbelliferæ, and from all others, it may be readily distinguished by its smooth, red-spotted stem, very numerous umbels, and the prominent crenated ridges of the fruit.

The Eastern plant has rather longer fruit, and the ridges are sometimes not crenated. There is also a variety with blunter leaf-segments and more divaricate branches.

We have described the fruit as without vittæ, but, in reality, these organs exist under the unusual form of numerous small channels, which are obvious in the young fruit, but never acquire the development common in most Umbelliferæ. On the contrary, they completely shrivel up by the time the mericarps reach maturity.

Syme, E. Bot., iv, p. 173; Hook. f., Stud. Fl., p. 154; Watson, Comp. Cyb. Brit., p. 186; Gren. & Godr., Fl. France, i, p. 750; Boiss, Fl. Orient., ii, p. 922; A. Gray, Man. Bot. N. U. States, p. 198; Hiern, in Fl. Trop. Africa, iii, p. 9; Lindl., Fl. Med., p. 57.

Official Parts and Names.—1. Conii Folia; the fresh leaves and young branches, also the leaves separated from the branches and carefully dried, gathered from wild British plants when the fruit begins to form: 2. Conii Fructus; the dried ripe fruit (B. P.). 1. The leaves and young branches, gathered from wild plants when the fruits begin to form, and carefully dried: 2. The ripe dried fruit (I. P.). 1. Conii Folia; the leaves: 2. Conii Fructus; the full-grown fruit, gathered while yet green, and carefully dried (U. S. P.).

1. Conii Folia.—*General Characters and Composition.*—The characters given in the British Pharmacopœia are as follows:—Fresh leaves decompound, smooth, arising from a smooth stem with dark purple spots; dried leaves of a full green colour and characteristic odour. The leaf rubbed with solution of potash gives out strongly the odour of conia.

Hemlock leaves have essentially the same active constituents as the fruit, but in much smaller proportion; thus Geiger only obtained from the fresh herb about one ten-thousandth part of conia. Even this small proportion of conia is diminished by the process of drying, and ultimately entirely lost when the dried leaves are kept for any length of time, as is noticed under the head of "Collection." Doubtless, however, the amount of active constituents will vary according to the season, being greater in dry sunny summers than in cold damp ones. The nature of these constituents is described below under "Conii Fructus."

Collection, Drying, and Preservation.—The leaves and young branches should be gathered when the flowers are fully matured, or when the fruit begins to form as directed in the British Pharmacopœia. These parts then possess their greatest medicinal activity, for the reasons explained in our description of *Digitalis purpurea.*

When carefully dried at a moderate heat, the leaves preserve their fine green colour, and characteristic odour; and when rubbed with solution of potash they should evolve the odour of conia.

According to John Harley the fresh leaves are reduced to one fourth of their weight in the course of drying; one ounce of the dried leaf therefore represents four ounces of the fresh. The dried leaves should be preserved in closed, perfectly opaque, and dry vessels, and in a cool place; or they may be powdered, and the powder preserved, excluded from solar light, in well-stopped bottles. Pereira has pointed out that the dried leaves, however carefully prepared, cannot be relied on if kept for any length of time; and in this he has been confirmed by Harley, who found, from comparative observations, that the fresh leaf contained about $\frac{1}{4}$ per cent. of conia at most, and that one half of this was lost in the process of drying. As one ounce of the dried leaf, therefore, as just noticed, represents four ounces of the fresh, it contains twice as much conia as an equal weight of the fresh. This, however, Harley adds, is only true of the recently dried leaves, for by keeping they rapidly lose conia and at the end of a year contain merely a trace. The odour test by solution of potash is only to be relied on, as also shown by Harley, as a proof of the presence of conia, but in no degree as proving their value therapeutically, for he ascertained that preparations of hemlock containing conia only in such proportions as to render them quite useless in medicine, gave out a distinct odour of the alkaloid when rubbed with that solution.

2. Conii Fructus.—Hemlock fruit or conium fruit is commonly known in commerce as Hemlock seed or Conium seed; indeed, this latter name is adopted in the Pharmacopœia of the United States. The dried ripe fruit is official in the British Pharmacopœia and the Pharmacopœia of India; but in the Pharmacopœia of the United States, the full-grown fruit, gathered while yet green, and carefully dried, is directed to be used.

Sir R. Christison and W. Manlius Smith first demonstrated that the unripe fruit was more active than that which was fully mature; and their observations have been confirmed and extended

by Harley. The latter states that the "fruits contain the largest amount of conia just before they come to maturity, that is, when they have attained their full size, but are still soft and green. At this stage they should be collected, spread out in thin layers on porous paper, dried in a warm, shady room, at about the temperature of 80°, and then preserved in a dry place in well-closed tin canisters. With these precautions they will retain their virtues unimpaired for more than a year." Harley also remarks, "I have further proved that the fruit undergoes such rapid deterioration by keeping, that the commercial article, which is chiefly derived from the Continent, is almost destitute of the active principle." It is for these reasons that the dried ripe fruit has been rejected by the compilers of the Pharmacopœia of the United States, and the fruit directed to be collected and dried as described by Harley.

General Characters and Composition.—The characters of Hemlock fruits have been already fully given in our botanical description. In the British Pharmacopœia they are briefly summed up as follows:—Broadly-ovate, compressed laterally; half fruit with fine waved or crenated ridges. Reduced to powder and rubbed with solution of potash, they give out strongly the odour of conia.

The half-fruits (*mericarps*) are those commonly seen in the pharmacies. The dried ripe fruits have but little taste or odour; but when dried in an unripe state, they have a strong hemlock odour and taste.

Hemlock fruits contain a *volatile oil;* three alkaloids termed *conia, conine,* or *conicine, conhydria,* and *methyl-conia;* and other unimportant constituents. The so-called *cicutine,* referred to by us under *Cicuta virosa,* as being used in Edinburgh and elsewhere as a remedial agent, is *conia.* By far the most important of these constituents is conia, for upon it the active properties, according to Harley, of both the fruit and leaves entirely depend. But some of the activity is attributed by others to methyl-conia, which is always associated with it. The proportion of conia is, however, less in the leaves than in the fruit; thus, Harley, as already noticed, estimates that the fresh leaves contain about $\frac{1}{4}$ per cent. of conia at most;

while the yield from the fruits just before maturity has been stated at $\frac{4}{5}$ per cent. When pure, conia is a volatile, colourless, oily liquid, strongly alkaline, with poisonous properties, and a strong disagreeable odour, which has been compared to that of mice. It is slightly soluble in water; but freely soluble in ether and in alcohol. Its specific gravity and boiling point have been variously estimated by chemists; the most recent experiments by A. Petit give the former at 0·846 at about 54°, and the latter at 338°.

Medical Properties and Uses.—As a medicine, conium is sedative and antispasmodic; and in sufficient doses it acts as a paralyser to the centres of motion. In its action it is therefore directly antagonistic to that of strychnia, and hence it has been recommended as an antidote in poisoning by that alkaloid, and in other poisons of the same class; and in hydrophobia, tetanus, &c. Garrod states, however, that it is useless in strychnia poisoning and tetanus. Its action on the motor centres indicates its value as a remedy in cases of undue nervous motor excitability; but in order to produce favourable results, it must be given, according to Harley, in sufficient doses to produce, to a greater or less extent, its peculiar physiological action. Harley recommends hemlock in the undue excitement of the motor centres arising from dentition in children; in epilepsy, when the irritation is central and motor, as in epilepsy from dentition, but when peripheral or emotional, it is useless; in cramp or spasm of the voluntary muscles; in the early stage of paralysis agitans; in chorea; in laryngismus stridulus and other spasmodic affections of the larynx; in spasm of the gullet; in spasm of the orbicularis which attends keratitis; in acute mania; and many other cases. In the form of a poultice, conium is also a valuable application to relieve the pain of cancerous affections.

In poisonous doses it produces complete paralysis with loss of speech, the respiratory function is at first depressed, and ultimately ceases altogether, and death results from asphyxia. The mind, &c., remain unaffected to the last.

The alkaloid conia has also been used both internally by the stomach, and hypodermically, but Harley says, in my hands conia

"has not proved a satisfactory drug, for it is variable both in strength and in action."

Per. Mat. Med., vol. ii, pt. 2, p. 192; Per. Mat. Med., by B. & R., p. 778; Pharmacographia, p. 266; U. S. Disp., by W. & B., p. 327; J. Harley, The Old Vegetable Neurotics, p. 94; Garr., Mat. Med., p. 262; Royle, Mat. Med., by J. Harley, p. 586; Young, in Pharm. Journ., vol. v, ser. 2, p. 395; Garrod, Lectures on 'The Value of the New Remedies of the British Pharmacopœia,' in 1864, at the Royal College of Physicians; Manlius Smith, Transactions of the New York State Medical Society for 1867; Harley, in Pharm. Journ., ser. 2, vol. viii, pp. 413, 452, 572, 601, and 710, and vol. ix, pp. 53 and 471; A. Petit, in Pharm. Journ., ser. 3, vol. viii, p. 649, and in Proc. Amer. Pharm. Assoc., vol. xxvi (1878), p. 607.

DESCRIPTION OF PLATE.

Drawn from a specimen grown in the Royal Botanic Society's Garden, Regent's Park.

1. Portion of the upper part of a large plant.
2. A flower.
3. A petal.
4. Pistil.
5, 6. Fruit.
7. Commissural, and—8. Dorsal surface of a mericarp.
9. Transverse section of fruit.
10. Part of lower portion of stem.

(2–4, 6–9 enlarged.)

CICUTA VIROSA, *Linn.*

N. Ord. UMBELLIFERÆ.

Tribe *Ammineæ*.

Genus Cicuta,* *Linn.* B. & H., Gen., i, p. 889. Species 3, natives of the northern temperate regions.

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119. Cicuta virosa, *Linn., Sp. Plant., ed.* 1, *p.* 255 (1753).

Cowbane. Water Hemlock.

Figures.—Woodville, t. 39; Hayne, i, t. 37; Steph. & Ch., t. 89; Nees, t. 285; Philosophical Transactions, xliv, tt. 4, 5; Syme, E. Bot., iv, t. 571; Reich. Ic. Fl., Germ., xxi, t. 1853; Nees, Gen. Fl. Germ.

Description.—A perennial herb, with a short, thick, vertical, hollow, truncate rootstock, with transverse partitions within at the nodes, and giving off whorls of slender roots. Stem 2—4 feet or more high, erect, stout, branched, slightly furrowed, glabrous, hollow. Lower leaves large, stalked 1—2 feet long, narrowly triangular in outline if laid flat, bi- or tripinnate, the petiole and rachis thick, cylindrical, hollow, striate, with the pinnæ and leaflets coming off from the top and projecting upwards, leaflets opposite, sessile, 1—2 inches long, linear-lanceolate, often very deeply cleft, acute at both ends, frequently decurrent below, sharply serrate, quite glabrous, bright green; the upper leaves much smaller, with a dilated sheathing base, simply pinnate or bi-ternate, with smaller leaflets. Umbels rather large, long-stalked, terminal, but the lower ones appearing lateral and opposite the leaves, lax, rays 12—16, long, slender, curved, general involucre wanting, partial of about 8 linear subacute 1-nerved bracts, usually shorter than the pedicels. Flowers small, on long slender pedicels, about 20 in an umbel, not crowded. Calyx-teeth small, triangular, acute. Petals roundish-obovate, with a long acute inflexed point, those of the marginal flowers slightly radiant, all pure white. Stamens longer than the petals, spreading, anthers at first red, afterwards

* The *Cicuta* of the Romans was the κώνειον of the Greeks, *Conium maculatum* (see no. 118). Linnæus transferred the name to the present species, which possesses equally poisonous qualities (see Hort. Cliffort., p. 100).

violet-pink. Stigmas short, divaricate, disc flat, white, pulpy. Fruit small, about $\frac{1}{10}$th inch long and about $\frac{1}{8}$th wide, depressed-orbicular, capped with the persistent calyx-teeth and the spreading or reflexed styles, somewhat constricted at the flat commissure, smooth, pale brownish-orange, mericarps scarcely laterally compressed, primary ribs broad, nearly flat, thick and corky, especially the lateral (commissural) ones, vittæ solitary in each furrow, small but rather prominent, circular on section, two commissural ones small, closely placed.

Habitat.—A native of northern and central (rarely also southern) Europe, extending to the extreme north and also reaching eastward through Siberia to Kamptschatka, Arctic America, Canada and Greenland, thus extending round the arctic regions. It is not recorded from Iceland. In Great Britain the Cowbane is a local plant, and in the south of England rarely to be met with, though it abounds in some other parts, as in Cheshire and the Norfolk fens. It grows in pits, ditches, and the borders of large pieces of water, and flowers in July and August.

It would appear to have been at one time more common here than now, drainage having doubtless reduced suitable localities. There was, however, formerly much confusion among the "Water Hemlocks;" and *Œnanthe Phellandrium,* Lam., another poisonous species (figured in Woodville, t. 37, Steph. and Ch., t. 10), and *Sium latifolium,* L., have been more than once misnamed *Cicuta.* Dr. W. Watson in the 'Philosophical Transactions' for 1747 did much to clear up the confusion prevailing with regard to this species and *Œnanthe crocata* in the writings of the older botanists and pharmacists.

C. maculata, L., a common plant in the United States, is a close ally of the present species, from which it differs chiefly in its larger leaflets, spotted stems, and large tuberous roots. It is figured in Bigelow, i, t. 12.

Syme, E. Bot., iv, p. 97; Hook. f., Stud. Fl., p. 159; Watson, Comp. Cyb. Brit., p. 187; Ledebour, Fl. Rossica, ii, p. 241; Hook., Fl. Bor.-Amer., i, p. 259; W. Watson, in Phil. Trans., xliv, p. 236; Lindl. Fl. Med., p. 34.

Part Used and Names.—CICUTA VIROSA; the plant. This plant, which is commonly known under the names of *Water Hemlock* and *Cowbane,* was never official in our Pharmacopœias, or even used to any extent in regular medical practice; but is described here on account of its being one of the most poisonous of our indigenous plants the characters of which ought to be known by all medical practitioners and pharmacists. It is remarkable, however, that Sir R. Christison found that both this plant and *Œnanthe crocata* were innocuous when grown near Edinburgh.

The celebrated hemlock-potion of the ancient Greeks, by which criminals were put to death, has been sometimes stated to have been prepared from this plant; but this is evidently an error, as it does not grow in Greece, or except rarely even in southern Europe. The chief ingredient in this poison was evidently the juice of the *Common Hemlock* (*Conium maculatum,* L.), which was formerly known to botanists under the name of Cicuta, and indeed was official in the London and Edinburgh Pharmacopœias under this name. Another species of *Cicuta,* namely, *C. maculata,* or *American Water Hemlock,* is a native of the United States, and also possesses very poisonous properties.

Composition.—No complete analysis of this plant has been published, but an alkaloid termed *cicutine* is said to exist in it. Nothing definite, however, is known of this alkaloid; and the authors of Pharmacographia distinctly state that no poisonous alkaloid can be obtained from *Cicuta virosa.* The so-called *cicutine,* which has been used as a medicinal agent in Edinburgh and elsewhere, is *conia,* the chief active principle of *Conium maculatum.* The poisonous constituent of *Cicuta virosa* is therefore entirely unknown; it was formerly supposed to be volatile, because the plant was said to be less poisonous dried than when fresh. But although a volatile oil may be obtained from the plant by distillation with water, Simon found that this was not poisonous; and the more recent experiments of Julius Trapp, of St. Petersburg, Haines, and Müller, have shown that this oil belongs to the class of aromatics, and is identical with the oils of Cumin, Thyme, and Ajowan. An analysis of the fruits of *Cicuta maculata,* L., by Young, in the United

States, yielded albumen, tannic acid, gum, fixed oil, resin, volatile oil, chlorophyll, colouring matter, a peculiar acid, and an organic alkaloid, which he supposed to be identical with *conia*.

Medical Properties and Uses.—The properties of *Cicuta virosa* are said to resemble those of *Conium maculatum*, when used as a medicinal agent, but it is now never employed internally. Externally it is sometimes used as an anodyne poultice in rheumatic affections and to allay local pains. The American *Cicuta maculata* has also been highly recommended as a remedy in nervous and sick headaches.

The principal interest attaches to this plant in consequence of its poisonous nature. Numerous fatal cases of poisoning are on record of cattle from eating the herbage, and of men and children from eating the roots. It is said, however, that goats and sheep may eat it with impunity. Similar fatal cases of poisoning both to men and cattle have occurred in the United States from *Cicuta maculata ;* indeed, this plant is said to be even more virulent than it. The action of these plants is that of an acrid narcotic, producing cerebral disturbance, such as giddiness and coma, and also tetanic spasms, and inflammation of the stomach. The immediate cause of death (which, in some cases, has occurred in half an hour, although generally not for more than twelve hours) has been paralysis of the muscles of respiration. Infusion of galls has been recommended as an antidote ; but it cannot be relied upon by itself. The best treatment is to administer an emetic of sulphate of zinc or common mustard and water, and when the stomach has been emptied of its contents, milk and other nutritious and non-irritating substances should be given to support the system.

Steph. & Church., Med. Bot., by Burnett, vol. ii, pl. 89; U. S. Disp., by W. & B., p. 1568; Taylor, on Poisons, p. 810; Pharmacographia, pp. 266, 270, and 296; Young, in Pharm. Journ., ser. 2, vol. v, p. 395; Trapp, Ann. der Chem. u. Pharm., vol. cviii (1858), p. 386; Annal. der Pharm., vol. xxxi, p. 258; Proc. Amer. Pharm. Assoc. for 1858, p. 253; Pharm. Journ., vol. ii, ser. 3, p. 1063; Lancet, Sept. 16 (1871), p. 396.

DESCRIPTION OF PLATE.

Drawn from a specimen cultivated in Kew Gardens.

1. Portion of flowering stem.
2. A flower.
3. A petal.
4. Pistil and calyx.
5, 6. Fruit.
7, 8. Mericarps.
9. Transverse section of fruit.
10. Part of lower leaf.

(2–4, 6–9 enlarged.)

J.Blair F.L.S. ad nat. del. et lith.

M & N Hanhart imp.

CARUM AJOWAN.

N. Ord. UMBELLIFERÆ.

Tribe *Ammineæ*.

Genus Carum,* *Linn.* (amend.). B. & H., i, p. 890 (includes *Petroselinum, Ptychotis,* &c.). Species about 50, mostly natives of temperate and warm regions of the Old World.

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120. Carum Ajowan †

Ajowan. Ajwan. Joan.

Syn.—Ammi copticum, *Linn.* Ptychotis coptica, *DC.* P. Ajowan, *DC.* Ligusticum Ajowan, *Roxb.*

Figures.—Berg, Characterist., t. 54, fig. 415; Wight, Ic. Fl. Ind. Or., t. 566.

Description.—An annual herb, from 1 to 3 feet in height. Stem erect, cylindrical, slender, smooth, striate, hollow, with numerous long branches. Leaves few, distant, small, alternate, the lower ones on long stalks, the upper on shorter ones, petioles dilated and stem-clasping at the base, the lower tripinnate, 3 or 4 inches long, the upper bipinnate, smaller, segments linear filiform acute, spreading, quite smooth. Umbels small, about $\frac{3}{4}$ inch across, numerous, erect, long-stalked, flat, primary rays 6—8, somewhat unequal, involucre of 5 or 6 small linear bracts, persistent, partial involucres of a few bractlets exceeding the pedicels. Flowers very small, crowded, all bisexual. Calyx teeth minute, triangular. Petals broader than long with a wide base, undulated, deeply bilobed, but without an inflexed point, with a broad hairy midrib, pure white. Stamens with short filaments about as long as the petals, anthers red. Ovary densely papillose-pubescent; styles spreading horizontally. Fruit very small $\frac{1}{16}$—$\frac{1}{10}$ inch long, ovate, rounded, slightly constricted at the commissure, brownish-gray: mericarps not compressed, the primary ribs wide, prominent, rough, with numerous small tubercular asperities, vittæ

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* *Carum*, a form of *careum*, in Greek κάρειον and κάρος, the classical name of some small Umbelliferous plant.

† *Ajowan*, the vernacular Hindoo name.

The fruits are also much employed in India, both by the natives and Europeans, as a condiment.

Dale, Pharmacologia (1693), p. 211; Percival, Essays, vol. ii, p. 226, and Med. Comment. (1773), vol. i, p. 276; Pharmacopœia of India, pp. 99 & 447; Pharmacographia, p. 269; Stenhouse, in Pharm. Journ., ser. 1, vol. xiv, p. 272; Cooke, in Pharm. Journ., ser. 3, vol. i, p. 1007; H. Müller, Jahresbericht of Wiggers and Husemann, 1869, p. 86; Wood, Madras Quart. Med. Journ., 1862, vol. v, p. 293; Gerrard, in Pharm. Journ., ser. 3, vol. viii, p. 645; Willmott, in Pharm. Journ., ser. 3, vol. viii, p. 706.

DESCRIPTION OF PLATE.

Drawn from a specimen in the Kew herbarium collected in India by Wight.

1. Upper portion of a plant.
2. A flower.
3. A petal.
4. A pistil.
5, 6. Fruit.
7. Section of the same.
8. Lower part of plant.

(2–4, 6, 7 enlarged.)

L. Blair ad nat. del. et lith.

M&N.Hanhart imp.

CARUM CARUI. *Linn.*

N. Ord. UMBELLIFERÆ.

Tribe *Ammineæ*.

Genus Carum,* *Linn.* (amend.). B. & H., i, p. 890 (includes *Petroselinum*, *Ptychotis*, &c.). Species about 50, mostly natives of temperate and warm regions of the old world.

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121. Carum Carui,† *Linn., Sp. Plant., ed.* 1, *p.* 263 (1753).

Caraway.

Syn.—Bunium Carui, *Bieb.*

Figures.—Woodville, t. 41; Hayne, vii, t. 19; Steph. & Ch., t. 59; Nees, t. 276; Berg & Sch., t. 25 c; Syme, E. Bot., iv, t. 582 (bad); Reichenb., Ic. Fl. Germ., xxi, t. 1872; Nees, Gen. Fl. Germ.

Description.—Biennial (or annual), root tapering, brown, often branched below. Stem erect, slender, cylindrical, hollow, faintly striate, smooth, much branched, branches ascending. Root-leaves several, 6—9 inches long, on rather long petioles, narrowly triangular in outline, bi- or tri-pinnate, primary pinnæ sessile, opposite, closely placed so as to overlap at the base, broadly triangular in outline, ultimate divisions linear, acuminate, glabrous, pale green; stem-leaves alternate, small, with large sheathing scarious brown petioles, pinnate or bipinnate, the ultimate segments very narrow and pointed; at the base of the sheathing petiole on either side is a sessile pinnate stipule with filiform segments. Umbels numerous, long-stalked, often irregular, of about 8—10 slender rays, involucre of 1 or few filiform bracts, or wanting, partial involucres 0 or a single small bract. Flowers small, about $\frac{1}{10}$ inch across, the central ones usually barren. Calyx-tube obsolete. Petals broadly oval, notched, with an entire inflexed apex, white, stylopod conical. Fruit nearly $\frac{1}{8}$ inch long,

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* *Carum*, a form of *Careum*, in Greek κάρεον and κάρος, the classical name, but very doubtfully referable to this species.

† *Carui* was a name used by the mediæval pharmacists for the drug. Though it looks like a Latin genitive (as though for *carui semina*) it is said to be from the Arabian name *Karawya*. The English "Caraway" is clearly a further corruption of the same word.

oblong-ovoid, slightly compressed laterally, capped by the short spreading styles, smooth, scarcely constricted at the commissure which is flat, primary ridges prominent, narrow, blunt, pale, equal, vittæ large, one in each furrow, and two on the commissural face, dark brown, mericarps somewhat curved, readily separating from the bifid carpophore, and remaining suspended by their apex.

Habitat.—The Caraway plant has a somewhat peculiar distribution, and it is difficult to determine where it is native and where merely naturalised. It is a very common plant in the North of Europe and extends into Lapland, Finland, and Siberia, to within the arctic circle and to Iceland; in central Europe it is also widely distributed, but becomes scarce in the west, and scarcely occurs in the Mediterranean district or Asia Minor; it is, however, found in the Caucasus and the Western Himalaya. In Britain it is by no means uncommon in waste places, moist fields, &c., but is not considered to be native here by most writers; De Candolle, however, is inclined to believe it to be so. The plant is cultivated in this country in Essex and Kent, but much more largely in Holland, Prussia, and North Russia. A remarkable annual form is also grown in Morocco, which is described by Hanbury, who cultivated it, as having a stem 4 feet high, and also differing from the plant of Europe in its more divided foliage, more spreading umbels, larger flowers, shorter style, and more elongated and paler fruit.

Caraway flowers in its second year in June, and the fruit is ripe in July and August. The stipular auricles at the base of the petioles are worthy of remark in this usually exstipulate Order.

The authors of the "Genera Plantarum" make a section, *Carui*, of their large remodelled genus *Carum*, which beside the present plant includes about twelve European species.

Hook. f., Stud. Flora, p. 157; Syme, E. Bot., iv, p. 111; De Candolle, Géogr. Bot., p. 663; Watson, Comp. Cyb. Br., p. 519; Flück. & Hanb., Pharmacogr., p. 271; Koch, Fl. Germ., p. 246; Gren. & Godr., Fl. France, ii, p. 729; Ledebour, Fl. Ross., ii, p. 248; Willk. & Lange, Prod. Fl. Hisp., iii, p. 92; Boiss., Fl. Orient., ii, p. 879; Lindl., Fl. Med., p. 37.

Official Parts and Names.—1. Carui Fructus ; the dried fruit : 2. Oleum Carui ; the oil distilled in Britain from Caraway fruit (B. P.). The dried fruit (*Carui Fructus*) (I. P.). Carum ; the fruit (U. S. P.).

1. Carui Fructus or Carum.—*General Characters, Varieties, and Composition.* Caraway fruits, or as they are commonly termed *caraways*, when seen in commerce, are usually separated into their two constituent parts or mericarps, which are ordinarily called *caraway seeds ;* or in some cases, the mericarps are loosely attached to the central axis or carpophore of the fruit. These mericarps or half-fruits vary in length in the different commercial varieties from about $\frac{1}{6}$ of an inch in the English caraways to nearly $\frac{1}{3}$ of an inch in the Mogador kind ; they are slightly arched, somewhat tapering at each end, and are marked with 5 fine pale-coloured longitudinal ridges, with intervening dark brown shining spaces, in each of which is a large and conspicuous vitta. Caraways have an agreeable aromatic odour; and a pleasant, somewhat sweetish, and spicy taste.

There are several commercial varieties of caraways ; those commonly distinguished in this country being English, German, Dutch, and Mogador. Those used in the United States are either of home growth or imported from Europe. These varieties vary chiefly in length, plumpness, and colour ; the English being shorter and plumper than the others, and of higher commercial value ; the American are shorter than the German ; and the Mogador are longer, paler coloured, and more stalky than the other varieties. Caraways are also exported from Finland, Russia, and other parts of the North of Europe.

The properties of caraway fruits depend entirely on a *volatile oil*, which is commonly known as *oil of caraway*, and is described below.

2. Oleum Carui (Oleum Cari, U. S. P.). *Oil of Caraway.*—Oil of Caraway is readily obtained by distillation of the fruits with water ; the amount, however, varies a good deal in the different varieties of caraway ; thus from about 3 to 6 per cent. ordinarily, but in some cases a larger quantity may be obtained. It is said

that those caraways which are derived from a northern or elevated locality yield the most oil. In this country the oil distilled from home-grown caraways is preferred, and is alone recognised in the British Pharmacopœia. Dutch oil is also regarded as better than that distilled in the southern parts of Germany. Oil of Caraway is nearly colourless or pale yellow when fresh, but it becomes darker yellow and even brown by keeping; it has the odour of the fruit, and a spicy, somewhat acrid taste. It is dextrogyrate; its specific gravity has been variously given at from 0·916 to 0·946. Some recent experiments of Dragendorff render it probable that oil of caraway, unlike volatile oils, as a general rule, may in some cases at least, become more soluble in alcohol by keeping. The experiments of Schweizer and Völckel show that oil of caraway is a mixture of two liquid oils, called *carvol* and *carvene*, which have different boiling points, and are separable by distillation; these two oils exist in the proportion of about $\frac{2}{3}$ of the former to $\frac{1}{3}$ of the latter. Carvene is a hydrocarbon; but carvol is an oxidised oil which is isomeric according to Gladstone, with the menthol or oxidised oil of spearmint, the myristicol of nutmegs, and the carvol of DILL FRUIT; it is also isomeric with the thymol of oil of thyme. The oily liquid called *carvacrol* is formed by the action of hydrated phosphoric acid on oil of caraway and some other substances.

Medical Properties and Uses.—Both the fruit and oil possess aromatic, stimulant, and stomachic properties. The fruit is often used to relieve the flatulent colic of children, &c.; but more frequently as an adjunct to other medicines as a corrective or flavouring agent. Oil of caraway is also employed for similar purposes; it is frequently added to purgative medicines to prevent griping. Caraway fruits are also used in veterinary practice for similar purposes. The oily liquid termed *carvacrol* is said to give immediate relief in toothache, when inserted into the cavity of a decayed tooth.

Oil of Caraway is also largely used in this country in perfumery, more especially in scenting soap; and the powdered fruits are "well adapted for mixing to form sachet powder."

The more important consumption of caraways is, however, as a spice, it being largely used in Europe and the United States in cakes, bread, pastry, confectionery, cheese, sauces, &c. The oil is also employed as an ingredient in alcoholic liquors.

The roots of the plant are sometimes considered to have a very agreeable taste, and are occasionally eaten in the North of Europe.

Per. Mat. Med., vol. ii, pt. 2, p. 160; Pharmacographia, p. 273; U. S. Disp., by W. & B., pp. 230 and 1304; Gmelin's Chemistry, vol. xiv (1860), pp. 283, 414, 416; Piesse's Art of Perfumery, p. 70; Buignet, Journ. de Pharm., Oct., 1861, p. 261; Journ. Chem. Soc., vol. x, p. 9; Pharm. Journ., vol. iii, 3rd ser., p. 746, and vol. vi, pp. 541 and 582; Med. Times, vol. xvii, p. 236; Flückiger, in Pharm. Journ., vol. vii, 3rd ser., p. 75.

DESCRIPTION OF PLATE.

Drawn from a plant in the Garden of the Apothecaries' Company, Chelsea.

1. Upper part of plant.
2. A root-leaf.
3. A flower.
4. A petal.
5. Section of ovary.

6 and 7. Fruit.

8. Commissural surface of a mericarp.
9. Transverse section of fruit.

(3–5 and 7–9 enlarged.)

PIMPINELLA ANISUM, *Linn.*

N. Ord. UMBELLIFERÆ.

Tribe *Ammineæ*.

Genus Pimpinella,* *Linn.* B. & H., Gen., i, p. 893. Species about 70, natives chiefly of the temperate parts of the Old World.

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122. Pimpinella Anisum,† *Linn., Sp. Plant., ed.* 1, *p.* 264 (1753).

Anise.

Syn.—Anisum officinale, *Moench.*

Figures.—Woodville, t. 52; Hayne, vii, t. 22; Steph. & Ch., t. 156; Nees, t. 275; Berg & Sch., t. 18 d; Reich., Ic. Fl. Germ., xxi, t. 1865.

Description.—An annual herb, with an erect, cylindrical, solid, striated, smooth or slightly pubescent stem, about one foot or more high and much branched above. Leaves alternate or the upper ones opposite, variable in form, the lowest ones on very long slender petioles, ovate-orbicular, rather deeply dentate, the upper ones with short, dilated, scarcely-sheathing petioles, ternately pinnate or pinnatifid, with long, wedge-shaped, acute segments which are entire or cut into long, linear, attenuated teeth, smooth, thin, pale green. Umbels numerous, rather small, long-stalked, flat-topped, with 8—14 rays, general involucre absent or of 2 or 3 very small bracts, partial of 1 or 2 linear bracts as long as the pedicels. Flowers small, the outer ones not radiant, not crowded, on longish pubescent pedicels. Calyx-teeth absent. Petals roundish, very concave, emarginate, with a long incurved tongue, pubescent externally, white. Filaments long, anthers pale cream-coloured. Styles long, spreading, stigmas capitate. Fruit about $\frac{1}{6}$ inch long, ovate-oblong, capped with the small stylopod, minutely pubescent, pale yellowish-grey, very slightly constricted at the broad, flat commissure; mericarps not readily separating, primary ribs prominent, slender, pale; vittæ small, irregular, several in each groove, and (usually) none in the commissure.

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* *Pimpinella*, a mediæval name; the same as *bipinella*, and referring to the pinnate leaves. It was applied to *Poterium*, &c., as well as to species of the present genus.

† *Anisum*, *ἄνισον*, the classical name; of Arabic origin.

Habitat.—Anise is a native of Egypt, Crete, Cyprus, and many islands of the Greek Archipelago. It was well known to the ancients, and was cultivated in Tuscany in Roman times. In the middle ages its cultivation had spread to Central Europe, and at the present day it is grown in several parts of Germany. The plant has been an inhabitant of English gardens from the middle of the 16th century, but it ripens its seed only in very warm summers. It is chiefly in warmer districts that it is grown, Southern Russia, Malta, Spain, and Greece producing large quantities. It has also been introduced into India and South America. The cultivated plant attains a considerably larger size than the wild one.

Boissier, Fl. Orient., ii, p. 866; Alefeld, Landwirthsch. Fl., p. 154; Lindl., Fl. Med., p. 38.

Official Parts and Names.—Oleum Anisi; the oil distilled in Europe from the fruit of Pimpinella Anisum, *Linn.*, Anise. And the oil distilled in China from the fruit of Illicium anisatum, *Linn.*, Star Anise (B. P.). The volatile oils distilled from the fruits of the above-named plants (I. P.). Anisum; the fruit of Pimpinella Anisum (U. S. P.). In the Pharmacopœia of the United States the oil of anise obtained from the fruit of *Pimpinella Anisum* is also recognised. The fruit of *Illicium anisatum* and the oil obtained by distillation from it are described under *Illicium anisatum*.

1. Anisum.—*General Characters and Varieties.*—Anise fruits, commonly called *aniseed* or *anise*, vary somewhat in length, but with the exception of the Russian variety, they average about the one fifth of an inch; their constituent mericarps are united and attached to a common stalk. Anise fruits are ovoid in form, greenish-brown in colour, and covered with short rough hairs. They have an agreeable aromatic odour, which is rendered more evident by friction, and a sweetish, warm, aromatic taste. Anise is chiefly imported into this country from Spain, Germany, Russia, and Chili. The more ordinary commercial varieties are those distinguished as Alicante from Spain, German, and Russian. The Russian fruits are smaller than those of the other varieties,

and have some resemblance to hemlock fruits, from which, however, they are readily distinguished by their ridges not being wavy, by having an abundance of vittæ, by their hairy surface, agreeable aromatic odour, united mericarps, and persistent pedicel. The most esteemed variety is the Alicante.

Composition.—The only constituent of anise fruits which is of any importance medicinally or economically is the official oil of anise; this is described below.

Medical Properties and Uses.—Anise is an agreeable aromatic, carminative, and stimulant, and is supposed, though without sufficient evidence, to promote the secretion of milk and some of the other secretions. It is employed in flatulent colic, more especially in that of children; and as a corrigent of griping cathartics. But in this country the oil of anise is commonly preferred to it as a medical agent.

Anise is chiefly used as a cattle medicine; it is also employed by the cook and confectioner as a flavouring agent. Anise is amongst the oldest of spices which have been in use, but the anise mentioned in the 23rd Chapter of St. Matthew, is incorrectly translated for Dill.

2. Oleum Anisi.—Oil of anise is contained in the fruit in the proportion of about 2 per cent.

General Characters and Composition.—Oil of anise is colourless, or of a very pale yellow tint, with the agreeable aromatic odour of the fruit, and an aromatic, spicy taste. Its specific gravity, which increases with age, varies from 0·977 to 0·983. It solidifies between 50° and 60° into a hard crystalline mass, and does not liquefy again under about 62°. It is soluble in all proportions in alcohol and ether. Oil of anise is almost entirely composed of *anethol* or *anise camphor,* which is described under *Fœniculum capillaceum;* it possesses but a feeble rotatory power, from the cause stated in that article; and is usually levogyre. In its general characters and composition, the oil obtained from the fruit of *Illicium anisatum,* which is also official in the British Pharmacopœia as already mentioned, under the same name, so closely resembles that derived from *Pimpinella Anisum,* that

the authors of Pharmacographia say, "We are unable to give characters by which they can be discriminated, although they are distinguished by dealers." It should be noticed, however, that while the oil from anise fruit solidifies between 50° and 60°, that from star-anise fruit does not solidify till below 35°.

Adulteration.—Oil of anise is frequently adulterated with spermaceti, wax, or camphor. The two former may be readily distinguished by their insolubility in cold alcohol, the latter by its odour. Procter found that one sample he examined contained as much as five-sixths of alcohol.

Medical Properties and Uses.—Oil of anise possesses the same aromatic, carminative, and stimulant properties as anise fruits, and, as already noticed, is commonly preferred to them as a medicine, and is alone official in the British Pharmacopœia. It is also regarded as a slight expectorant, and is consequently used in the form of a lozenge for coughs.

It is largely employed in France, Spain, Italy, South America, and elsewhere, in the preparation of cordial liqueurs.

Per. Mat. Med., vol. ii, pt. 2, p. 162; Pharmacographia, p. 277; U. S. Disp., by W. & B., pp. 127 and 1303; Watts, Dict. Chem., vol. i, p. 297; Pharm. Journ., vol. ii, ser. 1, p. 337; Amer. Journ. Pharm., vol. xxvii, p. 513.

DESCRIPTION OF PLATE.

Drawn from a cultivated specimen in the British Museum herbarium.

1. Portion of the upper part of a plant.
2. A flower.
3. A petal.
4. Pistil.
5, 6. Side view of the fruit.
7. Dorsal, and—8. Commissural view of a mericarp.
9. Transverse section of the same.
10. Lower leaves of a young plant.

(2–4, 6–9 enlarged.)

N. Ord. UMBELLIFERÆ.

Tribe *Seselineæ*.

Genus **Fœniculum**,* *Adans.* B. & H., Gen., i, p. 902. Species 3 or 4, natives of temperate parts of northern hemisphere.

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123. Fœniculum capillaceum,* *Gilib., Fl. Lithuan.*, iv, *p.* 40 (1782).

Fennel. Sweet Fennel.

Syn.—Anethum Fœniculum, *Linn.* Meum Fœniculum, *Spreng.* F. vulgare, *Gaertn.* F. officinale, *All.* F. sativum, *Bertol.* F. Panmorium, *DC.?* F. dulce, *DC.?*

Figures.—Woodville, t. 49; Hayne, vii, t. 18; Nees, t. 227; Berg & Sch., t. 27 d; Syme, E. Bot., iv, t. 601; Reichenb., Ic. Fl. Germ., xxi, t. 1930, 31; Nees, Gen. Fl. Germ.; Wight, Ic. Fl. Ind., t. 570 (*F. Panmorium*).

Description.—A large perennial (or biennial or annual?) herb, with a thick rootstock. Stem 2—4 feet high, erect, stout, cylindrical, finely striate, smooth and polished, bright green, solid or nearly so, much branched. Leaves stalked, petiole very long, dilated for the greater part of its length into an open flattened sheath, with an amplexicaul base, membranous margins, and at the top a prominent, oblong, obtuse ligule, blade much divided, of the lower leaves tripinnate or more, somewhat triangular in outline but the divisions not in one plane, ultimate segments numerous, linear, setaceous, acute, glabrous and shining, dark dull green, usually long, flexible, and rather drooping, but often short, spreading and divaricate, of the upper leaves smaller and much less divided; the uppermost leaves reduced nearly or quite to the dilated sheathing petioles. Umbels long-stalked, large, lax, with usually about 15—25 long, slender, spreading, curved, often unequal rays, quite without involucres; flowers about 15—20 in an umbel, rather long-stalked, not very small. Calyx-teeth quite

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* *Fœniculum*, the Latin classical name.

absent. Petals roundish, entire, but with a strongly involute tongue, bright yellow, none radiant. Stamens with long spreading filaments, bright yellow. Disk large and cushiony, styles very short. Fruit (in the ordinary plant) about $\frac{1}{5}$ inch long, oblong ovoid, capped by the conspicuous stylopod and short styles, smooth, greenish grey, commissure broad, flat, mericarps not compressed, primary ribs prominent, blunt, the marginal ones broader and somewhat thickened, vittæ solitary in the grooves and two in the commissure.

Habitat.—This well-known garden herb grows wild in most parts of Europe, except the North and East, is especially common in the Mediterranean region, and extends to Southern Russia, Asia Minor, Persia, and India. It is apparently native in England, growing on chalky and sandy soil, especially on or near sea-cliffs; it is also often found inland in chalky districts, but merely in a semi-wild state. It flowers here in July and August.

Fennel is a very variable plant in the wild state both as to size, habit, shape and cutting of leaf, number of rays in the umbel, and shape of fruit; and as it has also been under cultivation for centuries and for different purposes, there now exists several well-marked races. In Italy it is much cultivated for its young shoots, which are eaten as a vegetable. It is also grown there for its fruits, but this cultivation is more carried on in the South of France, especially at Nismes, and in many parts of Germany. The fruit of the Nismes plant (apparently *F. sativum*, Bertol.), called Sweet or Roman Fennel, differs greatly from that above described. It is twice as long, about $\frac{2}{5}$ inch, oblong or obovate-oblong in form, and often strongly curved, the ribs are wider and more prominent, and the vittæ smaller. So different do they appear from the common form that they have been supposed the produce of a different species, but it is a known fact that after some years' cultivation they revert to the form of the wild plant. Roman Fennel is often considered to be *F. dulce*, DC., which, however, is a much smaller plant with fewer rays to the umbel, and may perhaps be a distinct species. It is grown at Bologna and elsewhere for its swollen succulent stem, which is eaten as a vege-

table. *F. Panmorium*, DC., which is largely cultivated in India, is a small form of annual duration, now generally considered a variety of *F. capillaceum*, though this is somewhat doubtful.

Syme, Eng. Bot., iv, p. 133; Hook. f., Stud. Fl., p. 163; Watson, Comp. Cyb. Brit., p. 193; Gren. & Godr., Fl. France, ii, p. 712; Bertoloni, Fl. Italiana, iii, p. 339; Boiss., Fl. Orient., ii, p. 975; DC. Prod., iv, p. 142; Lindl., Fl. Med., p. 41; Flück. & Hanb., Pharmacogr., p. 274.

Official Part and Name.—Fœniculi Fructus; the fruit of Fœniculum dulce, *DC.* (B. P.). The fruit of Fœniculum vulgare, *Gaert.* (I. P.). Fœniculum; the fruit of Fœniculum dulce (U. S. P.).

General Characters and Varieties.—There are several varieties of Fennel Fruits known in commerce, as *Sweet* or *Roman Fennel*, *German* or *Saxon Fennel*, *Wild* or *Bitter Fennel*, *Indian Fennel*, &c. The fruits are commonly termed *Fennel Seeds;* they vary much in length, breadth, and other characters, and are of very different commercial value. Fennel fruits are thus described in the British Pharmacopœia :—"About three lines long and one line broad, elliptical, slightly curved, beaked, having eight pale brown longitudinal ribs, the two lateral being double; taste and odour aromatic." Wild Fennel fruits are short, dark coloured, and blunt at their ends, and have a less agreeable flavour and odour than those of sweet fennel; they are not official. The most esteemed fennel fruits vary from three to five lines in length, are somewhat obtuse at the ends, pale greyish green in colour, have an aromatic fragrant odour, and an agreeable aromatic sweet taste. Fennel fruits are frequently distinguished in commerce as *shorts* and *longs*, the latter being the most valued.

Composition.—The essential constituent of Fennel fruits is a *volatile oil*, of which the best varieties, such as the Sweet and German fennels, yield from 3 to 4 per cent.; other constituents are *sugar* and *fixed oil*. The volatile oil of fennel consists of variable proportions of a *liquid hydrocarbon*, which is isomeric with oil of turpentine, and of *anethol* or *anise-camphor*, the principal constituent of oil of anise, as is noticed in our description of that substance. *Anethol* contains oxygen in addition to hydrogen

and carbon, and exists in both a crystalline and fluid state. Three varieties of Oil of Fennel are distinguished in commerce, as *oil of sweet fennel, oil of bitter fennel, and oil of German or Saxon fennel.* The first, which has a perceptible sweet taste, is by far the best; it is obtained from the South of France. Oil of fennel is stated by Flückiger and Hanbury, to possess considerable rotatory power; this property, however, varies very much in the different commercial oils, that of oil of sweet fennel exhibiting it to by far the greatest extent; in all, however, it is dextrogyre. This rotatory power was found to be due entirely to the liquid hydrocarbon contained in the oil; hence in proportion to the quantity of this in the different varieties of oil, so will be their rotatory power, and hence also the feeble rotatory power of oil of anise, from its consisting almost wholly of anethol.

Medical Properties and Uses. — Fennel fruits are aromatic, stimulant, and carminative, resembling in these particulars the fruits of anise, caraway, and dill. They are rarely used in substance, but more commonly in the form of the distilled water and the volatile oil. Fennel water is alone official in the British Pharmacopœia and the Pharmacopœia of India; it is a useful remedy to relieve flatulence, and as a pleasant adjunct to other medicines to prevent griping, &c.

The chief consumption of fennel fruits is, however, in the preparation of cattle medicines. The oil is also much used for cordials.

The *roots* were formerly employed in medicine, but they are inferior in their properties to the fruits.

The plant is cultivated in this country and elsewhere as a potherb, and for garnishing. In some parts of the South of Europe, the young succulent shoots, and swollen fleshy stems, are also eaten as a vegetable, and in other ways.

Per. Mat. Med., vol. ii, pt. 2, pp. 164—166; Pharmacographia, p. 274; U. S. Disp., by W. & B., p. 410.

DESCRIPTION OF PLATE.

Drawn from a plant cultivated in the Chelsea Botanic Garden ; the fruit of the Nismes plant (*F. sativum*, Bert.) added from a specimen in the herbarium of the late D. Hanbury.

1. Portion of a plant.
2. A flower.
3. A petal.
4. Pistil.
5, 6. Fruit.
7. Dorsal—and 8. Commissural view of a mericarp.
9. Transverse section of the same.
10. Umbel of fruit of the variety cultivated at Nismes.
11. A single fruit of the same.
12. A leaf.

(2–4, 6–9 enlarged.)

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D Blair F.L.S. ad nat. del. et lith.

ŒNANTHE CROCATA, *Linn.*

N. Ord. UMBELLIFERÆ.

Tribe *Seselineæ*.

Genus Œnanthe,* *Linn.* B. & H., Gen., i, p. 905. Species about 30, natives of both old and new worlds in the northern temperate regions.

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124. Œnanthe crocata,† *Linn., Sp. Plant., ed.* 1, *p.* 254 (1753).

Water Dropwort. Water Hemlock. Dead-tongue.

Syn.—Œ. apiifolia, *Brotero.*

Figures.—Woodville, t. 38; Steph. & Ch., t. 35; Syme, E. Bot., iv, t. 597; Hook., Curt. Fl. Lond., v, t. 201; Brot., Phytograph. Lusit., t. 33.

Description.—A large perennial herb, with tubercular, fusiform, fleshy, pale ochreous roots, over 3 inches long and ¾ inch thick, traversed with several vascular bundles, exuding when broken across a colourless or bright pale-yellow juice, tapering into fibres below, smooth. Stem reaching 4 or 5 feet high, thick, erect, much branched above, furrowed, hollow and fistular, tough but rather weak, dark green, smooth. Lower leaves with a very short sheathing petiole, large, spreading, reaching more than a foot in length, broadly triangular in outline, tripinnate, the pinnæ opposite, leaflets sessile, 1—1½ inch long, roundish, with a wedge-shaped base, deeply and irregularly lobed, and cut into blunt, apiculate segments, thin, glabrous, dark green, paler and shining beneath; upper leaves much smaller, often opposite, nearly sessile, pinnate, segments narrower and acute. Umbels large, 4 or 5 inches across, terminal, convex, rays very numerous, slender, the outer ones 2 inches long, general and partial involucres usually of many short linear bracts. Flowers small, not very crowded, about 20 in an umbel, the outer

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* *Œnanthe;* the *οἰνάνθη* of the Greeks denoted primarily the flowers of the vine, but was also used for certain plants with white blossoms and tubercular roots (*Spiræa Filipendula* being probably one), perhaps from the vinous odour of their flowers.

† *Crocata*, from the yellow juice.

barren, on long slender pedicels, the inner fertile, nearly sessile. Calyx-teeth short, acute. Petals oblong, much incurved at the apex, 2-lobed, pure white, the outer ones of the marginal flowers somewhat radiant. Stamens longer than the petals. Stylopod conical, styles erect, persistent. Fruit $\frac{1}{4}$ inch long, ovoid-oblong, capped with the long, erect, persistent styles, smooth, pale brown, commissure broad, flat, mericarps not compressed, primary ridges broad, flat, the two marginal ones much thickened, corky, vittæ solitary in each groove, and two small, parallel, closely placed ones in the commissure.

Habitat.—This is a common plant in the south of England; and extends as far north with us as Argyle and Elgin in Scotland; its localities are ditches, boggy thickets, osier holts, and the banks of rivers; it is a specially noticeable species by the Thames near London. Abroad, the range of the plant is not extensive; it is confined to the west and south-west of Europe, and does not occur in Scandinavia, Holland, Germany, Russia, Turkey, or Greece. The *Œ. apiifolia*, Brot., common in Spain and Portugal, and reaching also into Corsica and Morocco, appears to be quite the same species as *Œ. crocata*. Brotero states, indeed, that in his species the juice of the roots is not yellow but quite clear; this may, however, have been due to the time of year at which it was examined; several observers have remarked the same condition in this country, and we have observed the juice to be quite colourless in summer, though, in the autumn, in the same plants, it became yellow on exposure.

There is considerable variety in the form of the leaf-segments, number of rays in the umbel, and involucral bracts.

Syme, E. Bot., iv, p. 128; Hook. fil., Stud. Fl., p. 165; Watson, Comp. Cyb. Brit., p. 192; Trimen & Dyer, Fl. Middlesex, p. 127; Gren. & Godr., Fl. France, i, p. 713; Lindl., Fl. Med., p. 39; Willk. & Lange, Prod. Fl. Hisp., iii, p. 53.

Part Used and Names.—ŒNANTHE CROCATA; the plant. It is not official in our Pharmacopœias, neither has it ever been used to any extent in medicine; but it is introduced here on account of its being one of the most poisonous of our indigenous plants.

The root is the most active part, but the whole of the plant possesses poisonous properties. It is remarkable, however, that Sir R. Christison found that both this plant and *Cicuta virosa*, were innocuous when grown near Edinburgh. *Œnanthe crocata* is commonly known under the name of *Hemlock Water Dropwort*; but also as *Dead Tongue*, *Water Lovage*, and *Yellow Water Dropwort*.

General Characters and Composition.—The stem and root when cut exude a yellowish juice, hence the specific name of the plant, and one of the common names by which it is known. This juice is described by Stephenson and Churchill as being at first milky and afterwards yellow, of a fœtid smell, and with an acrid, unpleasant taste. We have, however, never seen it milky, nor found it to have a fœtid odour. Further observations and experiments on its nature are, therefore, most desirable; for it is clear from the testimony of many persons that this juice is not always yellow. It will probably be found that its colour and poisonous properties depend materially upon the age of the plant, and the conditions under which it is grown; and that it also varies in the different parts of the plant according to the season of the year, &c. Although the juice is said to have a fœtid odour and disagreeable acrid taste, the roots are described as having neither an unpleasant taste or smell. They have been mistaken for parsnips, from which, however, they may be at once distinguished, for while the root of the parsnip is single and conical in form, that of *Œnanthe crocata* consists of several fleshy fusiform tubercules.

No analysis of this plant appears to have been published, but a peculiar *resinoid principle* was found by Mr. Gerding, of the United States, in the allied species *Œnanthe fistulosa*, which he termed *Œnanthin*, "of which half a grain, given to an adult, produced long-continued irritation of the fauces with hoarseness, and a grain occasioned vomiting." Mr. C. Fronfield, also of the United States, obtained from the fruits of another species—*Œnanthe Phellandrium*, a *volatile oil*, and his experiments further indicated the probable presence of a volatile alkaloid analogous to *conia*.

Medical Properties and Uses.—Notwithstanding its poisonous

properties this plant has been sometimes used, although to a very limited extent, medicinally. Thus the administration of an infusion of the leaves, and the expressed juice have, it is said, been found useful in the treatment of icthyosis, lepra, and some other obstinate cutaneous diseases. Dr. Hope, of Edinburgh, also found an infusion of the leaves very serviceable in promoting the menstrual discharge. The roots have been likewise used as poultices to whitlows, and to foul ulcers both in man and horned cattle. At the present time, however, no part of the plant is in use by regular medical practitioners, and until its properties are more thoroughly known, its employment as a medicine should not be recommended. It is chiefly interesting from the fact of numerous fatal cases of poisoning having occurred from the roots and other parts of the plant having been eaten in mistake for the similar parts of other harmless plants. It also acts as a virulent poison on horses and some other animals. It belongs to the narcotico-acrid group of poisons, the effects essentially produced being inflammation of the stomach, with giddiness, convulsions, delirium, and coma; death occurring in periods varying from half an hour to three hours after the poison has been taken into the system. The proper remedies in cases of poisoning by this plant are emetics, followed after the poison has been thoroughly discharged from the stomach, by demulcent drinks. The administration of chloroform appears also to be attended with good effect by relaxing the rigidity of the muscles. The most efficient remedies are, however, emetics, for numerous cases are on record where recovery has taken place when free vomiting has been induced. Thus, Orfila mentions that out of thirty-six soldiers who accidentally partook of the roots, only one died; the others, having vomited freely, recovered.

Properties of other Species of Œnanthe.—Most of the other species of *Œnanthe* found both in Great Britain and the United States are poisonous, although none appear to be so virulent as *Œnanthe crocata*. Some are, however, innocuous, and their roots, especially those of *Œnanthe pimpinelloides*, are esteemed as food in certain districts. Burnett says "they are replete with a bland farina, have something the flavour of a filbert, and are often sold at

Angers and in other continental markets," but, he adds, "although wholesome when cultivated, they are dangerous when wild." We have no evidence, however, of the roots of this species being thus sold for food at the present day, although their innocuous properties would appear to be thoroughly substantiated.

Some years ago, Dr. Turnbull, of Liverpool, highly recommended an alcoholic extract and essence of the fruits of another species, namely, *Œnanthe Phellandrium*, as very valuable and active remedies in the relief of consumption and bronchitis. The analysis of these fruits by Mr. C. Fronfield of the United States, has been already referred to.

Gerarde's Herball, by Johnson, p. 1060; Miller, Gard. Dict.; Steph. and Church, Med. Bot., by Burnett, pl. xxxv; Hooker, British Flora, 4th edit., p. 116; U. S. Disp., by W. and B., p. 1658; Bentley, Man. Bot., p. 782, and Pharm. Journ., ser. ii, vol. iii, p. 432; Pharm. Journ., ser. i, vol. xii, p. 590, and Ph. Jl., ser. iii, vol. i, p. 110; Gerding, in Amer. Journ. Pharm., vol. xxi, p. 68; Fronfield, in Amer. Journ. Pharm. May, 1860, p. 211; Pharm Journ., ser. iii, vol. v, p. 202; Seemann's Journal of Botany, vol. viii, p. 255.

DESCRIPTION OF PLATE.

Drawn from specimens collected by the Thames at Putney, Surrey.

1. Portion of a plant in flower and young fruit.
2. A flower.
3, 4. Fruit.
5. Back, and 6. Commissural surface of a mericarp.
7. Transverse section of the same.
8. Part of a lower leaf.
9. Roots.

(2, 4–7 enlarged.)

D Blair F.L.S. ad nat. del. et lith

ÆTHUSA CYNAPIUM, *Linn.*

M & N Hanhart imp

N. Ord. UMBELLIFERÆ.

Tribe *Seselineæ*.

Genus Æthusa,* *Linn.* B. & H., Gen. i, p. 907. The only species is the following.

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125. Æthusa Cynapium,† *Linn., Sp. Plant., ed.* 1, *p.* 256 (1753).

Fool's Parsley. Small Hemlock.

Figures.—Hayne, i, t. 35; Steph. & Ch., i, t. 8; Curt., Fl. Lond., fasc. 1; Syme, E. Bot., iv, t. 600; Reich., Ic. Fl. Germ., t. 1901.

Description.—An annual herb, with a small, tapering, branched, very pale, brownish-white root. Stem erect, 6 inches to 2 feet high, with many ascending branches, slightly striate, perfectly smooth, cylindrical, hollow at the base, solid above, somewhat swollen at the nodes, bright apple green, sometimes tinged with red. Leaves alternate, stalked, petiole short, slender, dilated and sheathing, stem-clasping at the base, with broad, white, membranous margins, blade very broadly triangular in outline, ternately bipinnate, *i.e.* with the two lower pinnæ very large, leaflets rhomboid-oval, deeply bipinnatifid, with narrow lanceolate, very acute segments, quite glabrous on both surfaces, shining beneath, full darkish green, often strongly tinged with dull violet-red. Umbels long-stalked on strongly striate peduncles, small, flat-topped, branches 5—10, straight, very unequal, the inner ones generally very short, general involucre none or of a single leaf, partial ones of 3 linear subulate, stiff bracts hanging down on the outer side of the umbels, the middle one the longest and in the central umbels often the only one present; flowers small, on slender pedicels, the outer ones slightly radiant. Calyx-teeth absent. Petals obcordate, with a deep notch and a short incurved tongue, white. Disk broad, flat, styles short, reflexed.

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* *Æthusa*, a name given by Linnæus; apparently from *αἰθύσσω*, to set on fire, from its poisonous properties.

† *Cynapium*, a name bestowed by Tournefort; a Greek form of the older name of Tabernæmontanus, *Petroselinum caninum*, i. e. Dogs Parsley.

Fruit small, about $\frac{1}{8}$ inch or a little more in length, and about the same in width, nearly orbicular, sometimes slightly narrowed at the top, not constricted at the commissure, smooth, pale greenish-grey ; mericarps dorsally compressed, semicircular on section, very readily separating, primary ribs very prominent and occupying the whole surface, thick, corky, strongly keeled, the lateral ones rather the larger, commissural surface flat, broad, vittæ small, solitary in each furrow, the two commissural ones strongly curved and together forming a lyre-shaped figure, red.

Habitat.—This is a common weed, occurring chiefly in gardens and other cultivated ground in all parts of Europe, including the British Isles, and extending into Siberia. The plant has been introduced into the United States. It is readily distinguished from our other smaller Umbelliferæ by the peculiar involucres. It varies greatly in size, and a very small state is common in arable land.

Syme, E. Bot., iv, p. 132 ; Hook. f., Stud. Flora, p. 166 ; Watson, Comp. Cyb. Brit., p. 193 ; Gren. & Godr., Fl. France, i, p. 712 ; Ledebour, Fl. Ross., ii, p. 270 ; Lindl., Fl. Med., p. 40.

Part Used and Names.—ÆTHUSA CYNAPIUM ; the plant. This plant is not official in any Pharmacopœia, neither has it ever been used in regular medical practice ; but it is introduced into the present work like *Œnanthe crocata* and *Cicuta virosa*, on account of its poisonous properties ; and hence being a common indigenous plant, it ought to be well known to medical practitioners and pharmacists. It is usually termed *Fool's Parsley*, from its resemblance to the common or garden Parsley ; it has also been called *Lesser Hemlock*.

General Characters and Composition.—The characters of this plant have been given above, but as it has been mistaken for both Parsley and Hemlock, it will be advisable for us to point out the more evident characters by which it may be distinguished from those plants. Its chief resemblance to Parsley is, in its leaves, but those of Fool's Parsley are more acute, of a darker green colour, and when bruised they emit a peculiar, disagreeable odour, which is altogether different from the smell of parsley. When

in flower it is easily distinguished by having no general involucre, or of a single leaf, and by the partial involucre being composed of 3—5, commonly 3, long, pendulous bracts, which are all directed to one side; the flowers are also all white, while those of the common Parsley are yellow. The curled variety of the garden Parsley is at once distinguished by its crisped leaves; hence to prevent mistakes it has been recommended that this only should be cultivated. From Hemlock it is known by its smaller size; by its stem not being spotted; by the absence when bruised, or more especially when rubbed with solution of potash, of the peculiar strong mousy odour of that plant; by its long, narrow, one-sided, pendulous, partial involucre; and by the ridges of the fruit not being wavy or crenate.

The active principle of fool's parsley is, according to Ficinus, an alkaloid, which he has termed *cynapine*. It is described as crystallising in rhombic prisms, soluble in water and alcohol, forming a crystallisable sulphate, and having poisonous properties. A further chemical examination of this plant is desirable.

Properties and Uses.—The whole plant possesses poisonous properties, but it does not appear to be of so virulent a nature as *Œnanthe crocata* and *Cicuta virosa*, for although there are several recorded cases of poisoning by it, only two appear to have terminated fatally. The symptoms it produces in man "are heat in the mouth and throat, nausea and vomiting; with headache, giddiness, stupor, dilated pupil, convulsions, and lock-jaw." When given to animals, it occasions convulsions and stupor. The only appearances met with at a post-mortem examination in a case of fatal poisoning by fool's parsley were redness of the lining membrane of the gullet and wind-pipe, with slight congestion of the stomach and duodenum. In cases of recovery it has been noticed, that vomiting has taken place early, either spontaneously from the plant having been eaten on a full stomach, or from the administration of emetics. The proper treatment therefore, in cases of poisoning by it, would be to give emetics and purgatives. It has also been stated, that after the

poison is evacuated, citric or some other vegetable acid should be administered; and if the stupor remains, cold affusions to the head, frictions to the body, and mustard poultices to the feet should be applied; together with small doses of sulphate of magnesia during the cure. It does not appear ever to have been used in medicine.

Miller, in his description of this plant, states, "most cattle eat it; but it is said to be noxious to geese." But in all recorded experiments with it on animals, it has had poisonous effects.

Steph. & Church., Med. Bot., by Burnett, vol. i, pl. 8; Miller, Gard. Dict., vol. i; Orfila, on Poisons, vol. ii, p. 251; Taylor, on Poisons, p. 814; Per., in Pharm. Journ., vol. ii, ser. 1, p. 340; Holmes, in Pharm. Journ., vol. v, ser. 3, p. 202.

DESCRIPTION OF PLATE.

Drawn from a specimen collected at Isleworth, Middlesex.

1. Upper portion of a plant.
2. Outer flower.
3. A petal.
4. Pistil.
5, 6. Fruit.
7. Commissural—and 8. Dorsal view of a mericarp.
9. Transverse section of the same.

(2–4, 6–9 enlarged.)

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D Blair F.L.S. ad sicc. del. et lith.

M & N Hanhart imp

FERULA NARTHEX, *Boiss.*

N. Ord. UMBELLIFERÆ.

Tribe *Peucedaneæ*.

Genus **Ferula**,* *Linn.* B. & H., Gen., i, p. 917. (Includes *Ferulago*, &c.) Species 70 or more, natives chiefly of the Mediterranean region and temperate Asia.

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126. Ferula Narthex,† *Boiss., Flora Orientalis*, ii, *p.* 994 (1872).

Sip, Sŭp (Thibet). *Thibetan Assafœtida.*

Syn.—Narthex Assafœtida, *Falconer.*

Figures.—Bot. Mag., t. 5168; Trans. Royal Soc. Edinburgh, xxii, tt. 21, 22; Royle, Mat. Med., figs. 69—71 (young plants).

Description.—A very large herb, persisting for a variable number of years, but perishing after it flowers. Root attaining a large size, 18 inches in length and 4—6 inches in diameter, tapering, branched, dark brown externally, white within, crowned above with the fibrous remains of the root-leaves of past years. Radical leaves several, spreading, large, $2\frac{1}{2}$ feet long by 3 feet wide, stalked, compound; petiole about 9 inches long, triangular-cylindrical, solid, prominent in the middle line above, quite smooth, striate, not sheathing or stipulate but with a short, membranous, intra-petiolar ligule at the base; rachis laterally compressed, double-winged along the top with the narrow decurrent bases of the leaflets; primary divisions 3, the centre rather the longest, the two lateral ascending and curved horizontally outwards; each division pinnate, leaflets opposite, ovate- or oblong-attenuate in outline, but cut down to the base into a few large linear-oblong, subacute, ascending lobes, often again cut in a similar manner and much attenuated and tapering below into the narrow wings along the rachis, margin entire, much incurved, quite glabrous, thick, shining, somewhat bullate beneath, pale glaucous apple-green on both surfaces. Flowering stem erect, stout, straight, reaching

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* *Ferula*, the Latin name for several large fennel-like plants.

† *Narthex*, Νάρθηξ, is the name of some large Umbellifer in Dioscorides.

8 feet or more in height, cylindrical, solid,* strongly furrowed, smooth, pale green, tapering, giving off many regular, simple, lateral branches from each leaf-axil, except the few lowest. Stem-leaves numerous, alternate, stalked, the lowest ones with a bipinnate lamina 13 or 14 inches long, and a short, wide, slightly inflated sheath nearly surrounding the stem; proceeding up the stem the laminæ gradually decrease in size and at length entirely disappear, whilst the sheaths become much larger and more inflated, the largest ones about the middle of the stem being 7—9 inches long by 8 broad, very much inflated, smooth, pale yellowish-green, and completely enclosing and concealing the stem; above this they become smaller, near the top are reduced to membranous scales about 1 inch long, and before reaching the summit they quite disappear. Flowers polygamous, the fertile umbels large, solitary, terminating the lateral branches; the male much smaller, very dense, globular, clustered at the ends of long peduncles coming off lower down; fertile umbels 5 or 6 inches across, rays 30—50, involucres none. Calyx-teeth very slightly marked. Petals oblong-ovate, acute, entire and not incurved at the apex, pale yellow, often unequal in the male flowers. Filaments about as long as the petals. Stylopod prominent, cupped, with a sinuous or lobed margin; styles long, spreading or deflexed, deciduous. Fruit between $\frac{3}{8}$ and $\frac{1}{2}$ inch long, oval, often slightly pointed at apex, quite smooth, pale greyish yellow, the vittæ purplish brown; mericarps thin, much dorsally flattened, the 3 dorsal ridges filiform, very slender, the lateral expanded into a broad wing $\frac{1}{4}$ the width of the mericarp, dorsal vittæ broad, solitary in each groove, commissural ones irregular, narrow, 4 or 6, sometimes divided.

(The description of the flowering plant, of which we have not seen a specimen, is compiled from Balfour and Hooker.)

Habitat.—This fine species was discovered by Dr. Falconer in 1838 growing among rocks in dry sunny places in the Vale of Astore

* The stem is figured hollow in Prof. Balfour's plate (tab. 21), but this is likely to be an error. As in other species the stem of *F. Narthex* is probably solid; that of Kæmpfer's assafœtida plant in the British Museum, which is $2\frac{1}{2}$ in. in diameter, is perfectly solid.

or Hussorah, on the northern slopes of the mountains dividing Kashmir from Western Thibet, and therefore in the latter country; in Kashmir itself it was not seen. As this was in September the plant was in fruit, and the leaves &c. mostly dried up and withered; some young roots were, however, carefully removed and raised in the Saharunpore Botanic Garden, of which Falconer was then director. He also sent seeds to the Botanic Garden at Edinburgh, which germinated in 1842, and continued annually to produce in the spring a crown of foliage,* and to increase the size of the crown of the root till 1858. In that year two plants pushed up flower-stems instead of root-leaves; these were cut off by frost, but in the succeeding year, 1859, several other plants flowered, one of which especially produced a large quantity of ripe fruit. From this plant, from the stem of which when the fruit was ripening little streams of Assafœtida ran, the above quoted figures were drawn, and from its seeds all the specimens of *Narthex* now living in the various botanic gardens have been raised. The plant died after flowering, and it is remarkable that neither at Edinburgh nor, we believe, elsewhere have any of the other specimens, though annually forming tufts of root-leaves, shown a tendency to flower.

Whether precisely the same species has been found in a wild state by other collectors is doubtful; but specimens collected by Falconer and by Dr. Thomson (also in fruit) on the southern side of the same mountain range, in Kashmir, are no doubt closely allied, though differing apparently in habit and in the considerably larger size of the mericarps. We have added a figure of this plant to our plate (figs. 9—11). Plants more or less allied, and also said to afford Assafœtida, have been met with in Herat and Afghanistan.

Dr. Falconer carefully compared his *Narthex* with the fragmentary specimens of Kæmpfer's Assafœtida plant—*Ferula Assafœtida* of Linnæus—in the British Museum, and was fully convinced of their agreement; for reasons, however, which are given

* Dr. Falconer saw these plants in 1844-5 at Edinburgh, and considered them to be identical with his Thibet plant.

under *F. Scorodosma* (see no. 127), we think it impossible to refer with any certainty Kæmpfer's plant to this or any other species.

The genus *Narthex* cannot be separated from *Ferula*. The points relied upon as distinctive are the absence of calyx-teeth and involucre, and especially the irregular vittæ in the commissure, which vary on each mericarp from 0 to 6.*

Falconer, in Proc. Linn. Soc. Lond., i, p. 309 (1846), Trans. Linn. Soc., Lond., xx, p. 285 (1851), and in Royle, Mat. Med., ed. 2, p. 461; Hooker, in Bot. Mag., t. 5168; Duckworth, in Pharm. Journ., xviii, p. 464 (1859); Balfour, in Gard. Chron., 1859, p. 487, and in Trans. Royal Soc. Edinb., xxii, p. 361 (1860); Flück. & Hanb., Pharmacogr., p. 280.

Official Part and Name.—ASSAFŒTIDA; a gum-resin obtained by incision of the living root of Narthex Assafœtida, *Falconer* (B. P.). A gum-resin obtained by incision of the living root of Ferula Asafœtida, *Linn.* (I. P.). ASSAFŒTIDA; a gum-resinous exudation obtained by incision from the root of Narthex Assafœtida, *Falconer* (U. S. P.).

Collection and Commerce.—The mode of collecting Assafœtida is described under *Ferula Scorodosma*. At the present day Assafœtida, or, as it is more properly called, Asafœtida, is, according to Flückiger and Hanbury, the produce entirely of Afghanistan;

* A second species of *Narthex* has been proposed by the late Prof. Oersted, founded on the plant which afforded the highly valued Silphium of the ancients, as represented on the coinage of Cyrenaica, a Greek colony of N. Africa, which owed its importance and prosperity to that much-prized drug. *Narthex Silphium*, Oerst., the Silphium plant, grew wild in the hilly interior parts of the country, and, as somewhat conventionally treated on the coins, certainly presents a considerably strong resemblance in habit to the flowering plant of the Edinburgh garden. Modern travellers in Barka (the ancient Cyrenaica), however, have not met with anything resembling this; and the plant generally regarded (though on scarcely sufficient grounds) as the Silphium plant is merely a variety of the commonly diffused Mediterranean Umbellifer, *Thapsia garganica*, Linn., which was named *T. Silphium* by Viviani, and is called "Driâs" in the country. This is certainly the "Silphium cyrenaicum" advertised by the late Dr. Laval. (See Oersted, in Overs. ov. d. Danske Vidensk. Selsk. Forhandl., 1869, translated in Journ. Bot., 1873, p. 176; Pharm. Journ., 1874, p. 598; Cauvet, in Bull. Soc. Bot. France, xxii, p. 23 (1875); Daveau, in Bull. Soc. Bot. France, xxiii, p. 20 (1876); Heringq, La vérité sur le prétendu Silphium de la Cyrenaique (1876.)

but Dymock says that the Asafœtida of European commerce is also produced in the province of Laristan, in Persia. The drug is forwarded to Bombay principally by way of the Persian Gulf; but some also reaches India by way of Peshawur and the Indus route, and by the Bolan Pass in Beloochistan. The Asafœtida which comes from Southern Persia is called by the Persian merchants *Anghuzeh i Lari*, and is regarded by Dymock as being probably derived from *Ferula Scorodosma;* while that from Afghanistan is supposed to be the produce of *Ferula Narthex*. It must be remembered, however, that this latter plant has never been found by any one except Falconer, for certain, and by him only in Thibet; hence, the botanical source of the Asafœtida of Afghanistan is merely conjectural. From Bombay the drug is exported to Europe, the United States, and other parts of the world. The consumption of Asafœtida in Europe, America, &c., is, however, but small in comparison with the amount used in Persia and India. The local name of the Asafœtida which is thus exported from Bombay is *hingra*.

General Characters.—The Asafœtida usually met with in commerce is in lumps, which are composed in a greater or less degree of agglutinated tears; this is termed *lump Asafœtida*. It is also rarely met with in separate tears, constituting the kind called *Asafœtida in tear*. Asafœtida has likewise occasionally been imported in a semi-fluid state, about the consistence of honey. Dymock suggests that this is due to the drug having been collected in an exceptionally moist season, which makes the juices of the plant unusually liquid; or it may be, as supposed by the authors of Pharmacographia, the first product which is derived from the Asafœtida plant, and which is called by Kæmpfer *milk*, as is noticed by us in our description of *Ferula Scorodosma* under the head of Collection of Asafœtida.

Asafœtida in Tear occurs in distinct, roundish, flattened, oval, or irregular-shaped tears, varying from the size of a pea to that of a walnut, of a yellow or brownish-yellow colour externally, and whitish internally. This kind of Asafœtida has less odour and taste than the lump Asafœtida, and is of inferior value to it.

drug is chiefly due to the sulphur oil contained in it. The resin probably acts as a stimulant expectorant." It is, however, but little used in Great Britain, although its consumption on the Continent is much larger. It is especially useful in flatulent colic; in hysteria and hysterical affections generally; also in asthma, hooping-cough, chorea, epilepsy, and other nervous diseases. It is likewise a serviceable remedy in the advanced stages of pneumonia, and in some forms of chronic bronchitis. It is also occasionally useful as a vermifuge, especially when the presence of worms causes sympathetic nervous affections. Asafœtida may be either administered by the mouth or as an enema; the latter form of administration is more particularly serviceable in cases of tympanitis and worms in the rectum.

Asafœtida is also used to some extent by the veterinary practitioner. It has been found especially serviceable in the treatment of chorea in the dog; and in the United States it was found of great benefit a few years since in an epidemic known as the "epizootic," which spread nearly all over the Union.

In India and Persia, besides its use in medicine, Asafœtida is very largely and generally employed as a condiment. It is also used to some extent on the Continent of Europe for a like purpose.

Other Products of the Asafœtida Plant.—The fruit of the Asafœtida plant or plants is imported into India under the name of *Anjudan* from Persia and Afghanistan, and is very largely employed as a medicinal agent by the native practitioners. The fruit of another umbelliferous plant, and closely resembling it in its characters, is also imported with it, under the name of *Dooqoo*, and appears to be used for a similar purpose. In the countries where the Asafœtida plant grows, the fresh leaves are cooked and used as an article of diet; and according to Dr. Irvine, the seeds and leaves of the plant, which he includes under the name of *kashim*, possess sudorific and carminative properties.

Other Kinds of Asafœtida.—Besides the *hingra* or the ordinary commercial kind of Asafœtida, Dymock states that, in the Bombay markets two other kinds are met with under the names of *Abushaharee Hing* and *Kandaharee Hing*, both of which occur

of varying qualities. The name of *Hing* is that given generally in Bombay to the purer sorts of Asafœtida, as we have already stated.

Abushaharee Hing is brought from the Persian Gulf, principally from Abushaher and Bunder Abbas. It is produced in Khorasan and Kirman, and its botanical source is, according to Dymock, the *Ferula alliacea* of Boissier. It is the ordinary *hing* of the Bombay markets, and is imported in large quantities. It is extensively used as a medicine in India, and as a condiment; the inferior Asafœtida or *hingra* being used only by the poorest classes in India, or is forwarded, as already described, to Europe and America, where it constitutes the kind in common use. This variety of *hing* is usually imported in skins, or rarely in wooden boxes, each package weighing 100 or more pounds. It is brown and translucent, and has a purely garlic odour. It "is obtained by taking thin slices from the crown of the root together with the gum-resin which has collected upon them until the root is exhausted." In commercial examples "the exhausted root is collected, cut up, and mixed with the Asafœtida which has been obtained in the manner described above. To do this water is required, which impairs the translucency. The quality varies greatly, the adulteration consisting in an undue proportion of root." It is also often further adulterated in Bombay by mixing it with gum Arabic in varying proportions, according to the price of the article required.

This kind of *hing* forms the third sort of Asafœtida described in Pharmacographia, and that which has been termed by Vigier, on account of its repulsive odour, *Asafœtida nauséeux*. It yields a large quantity of volatile oil, to which its odour is due. This oil has been examined by Flückiger, who found it to contain sulphur like that derived from ordinary Asafœtida, to which it appears to be closely allied; although, according to Flückiger, the two oils are not identical.

Kandaharee Hing is much rarer than the former kind in the markets of Bombay. Its botanical source is undetermined, though it is supposed by Dymock to be derived from *Ferula*

Narthex, the plant now being described. Dymock also believes that this drug will prove to be the superior kind of Asafœtida noticed by Bellew as obtained by wounding the terminal leaf-bud of the plant which produces ordinary Asafœtida. This kind of Hing comes from Kandahar sewn up in goat skins, forming small oblong bales, with the hair outside. "This Asafœtida, when fresh, is in flaky pieces quite wet with essential oil, of a yellow colour, opalescent, and with an odour like a mixture of garlic and oil of caraway. When kept for some time the gum-resin loses its moisture and gradually becomes perfectly transparent, and of a golden-yellow colour; the odour also loses much of its aroma, and approximates to that of the best Asafœtida of European commerce." It fetches a very high price, and is said to be used as a condiment and medicine by wealthy people in Central India.

Per. Mat. Med., vol. ii, pt. 2, p. 174; Per. Mat. Med., by B. & R., p. 765; Pharmacographia, p. 280; U. S. Disp., by W. & B., p. 154; Bellew, From the Indus to the Tigris, Lond., pp. 101, 102, 286, 321, &c., also, Journal of a Mission to Afghanistan, p. 270; Royle's Mat. Med., by J. Harley, p. 596; Gar., Mat. Med., p. 264; Watts, Dict. Chem., vol. i, p. 413; Pharmacopœia of India, p. 102; Duckworth, in Pharm. Journ., vol. xviii, ser. 1, p. 464; Pharm. Journ., vol. v, ser. 3, p. 945, vol. vi, p. 401, and vol. viii, p. 102; Amer. Journ. of Pharm., Feb., 1875, p. 49; Proc. Amer. Pharm. Assoc., vol. xxi (1873), p. 436, vol. xxiii (1875), pp. 178 and 497, and vol. xxiv (1876), p. 153.

DESCRIPTION OF PLATE.

Figs. 1—8.—The fruit from specimens in the British Museum collected by Falconer in Thibet; the root-leaf from a plant in the Royal Botanic Society's Garden, Regent's Park; the reduced figure of the whole plant and the flowers added after Balfour.

1. Whole plant (about $\frac{1}{12}$ nat. size).
2. Terminal portion of a root-leaf.
3. Male flower.
4. Bisexual flower.
5, 6. Dorsal, and—7. Commissural surface of a mericarp.
8. Transverse section of the same.

Figs. 9—11.—From a specimen in the herbarium of the late D. Hanbury collected by Falconer in Kashmir.

9. Portion of a plant in fruit.
10, Dorsal, and—11. Commissural surface of a mericarp.

(3, 4, 6–8 enlarged.)

7

6

D Blair ad sicc. del et lith.

Scorodosma

FERULA ~~FŒTIDA~~, *Benth & Hook f.*

M&N Hanhart imp

N. Ord. UMBELLIFERÆ.
Tribe *Peucedaneæ*.
Genus **Ferula**, *Linn.*

127. Ferula Scorodosma.*

Anguzeh (Persia). *Sassyk Karai* (Kirghiz). *Kawar* (Bucharia). *Persian Assafœtida.*

Syn.—Scorodosma fœtidum, *Bunge.*

Figures.—Mém. Acad. Imp. Sciences de St. Petersbourg, ser. 7, iii, tt. 1, 2, copied in Berg & Sch., tt. 26 c, 26 d.

Description.—A large perennial herb, enduring for several years, but (? always) perishing after it flowers. Root very large and thick, vertical, tapering, with several long spreading branches. Flowering-stem 5—7 feet high, erect, cylindrical, solid, smooth, striate, surrounded at the base by the fibrous remnants of the petioles of former years' leaves, branched only in the upper part. Leaves few, mostly near the base of the stem, the lower ones 2 feet long, on stout cylindrical petioles expanding below into a slightly inflated half-amplexicaul base, ternately divided into 3 nearly equal primary divisions, very broadly triangular in outline, and each bipinnate with few opposite pinnæ, leaflets few, opposite, sessile, and usually decurrent along the rachis, oblong-lanceolate, obtuse, smooth above, pubescent beneath, the upper leaves smaller, often sessile, those at the base of the branches reduced to their oblong amplexicaul bases. Flowers small, unisexual, monœcious, the female often abortive; umbels numerous, long-stalked, on branches spreading horizontally from the upper part of the stem and forming a wide dome-shaped head; male umbels smaller and with fewer rays, female umbels with 20—50 rays, and the flowers on shorter and thicker pedicels; involucres none. Calyx-teeth very faintly marked. Petals oval, obtuse, quite entire, and not incurved at the apex, spreading, persistent, yellow. Stamens (absent in female flowers)

* *Scorodosma*; from σκορόδον, garlic, and ὀσμή, smell.

with filaments exceeding the petals. Epigynous disk large (smaller in the male flowers), lobed, erect or incurved at the margin. Ovary (rudimentary in the male and abortive female flowers) rounded-ovoid, hairy, styles (absent in the male and abortive female flowers) long, strongly deflexed, on a short stylopod, stigmas globular-club-shaped. Fruit about ½ inch long by nearly ⅜ inch wide, oval, slightly obcordate in outline, much flattened, crowned by the deflexed styles and often by some persistent petals, mericarps thin and very much dorsally compressed, readily separating, sparingly hairy, with rather long scattered hairs, pale yellowish-brown, the 3 dorsal ridges slender and thread-like, the 2 lateral expanded into a thin dorsally convex wing ¼ the width of the mericarp, no vittæ.

As we have had no opportunity of seeing specimens of the leaves or flowers, the above description, except that of the fruit, is mainly derived from Boissier and from Borszczow's figures.

Habitat.—This plant was collected in 1841 by Lehmann on the east side of the sea of Aral, and also in the Karatau mountains south-east of Samarkand, in Bucharia. Bunge, in 1858-59, met with it in Herat near the Persian frontier of Afghanistan, and Borszczow found it on the west as well as the eastern side of the Aral sea. It probably extends over a wide district of Turkestan south of the River Xaxartes (Syr Darya), northern Afghanistan, and Khorassan, eastern Persia, growing in the most barren and desolate wastes. Mr. Schuyler noticed it in great profusion, forming, indeed, the most conspicuous vegetation of "the famished steppe" which extends south of Tashkend on the road to Samarkand. The great root takes many years to reach its full size during which leaves only are produced; the plant at length pushes up its tall flowering stem, which grows very rapidly. The flowers are produced in April and May, by which date the leaves have withered off; and the whole growth of the flowering stems and production of ripe fruit occupies only 40 or 50 days, after which the plant dies. Hence it happens that very few flowering specimens have been collected by travellers and found their way into herbaria.

Whether this plant is the *Ferula Assafœtida* of Linnæus, to which Boissier refers it, cannot be certainly decided. That species was founded entirely on the description and figures given by the celebrated traveller Kaempfer of the Assafœtida plant which he, in 1687, carefully observed in the province of Lauristan, Persia, near the town of Disgun, and which was hence called by him "Asa fœtida Disgunensis." His specimens are now in the Sloane Herbarium at the British Museum (vol. 212, fol. 107-109), and have been much studied. Borszczow carefully examined them, and was fully convinced that they agreed with *Scorodosma*. Royle (as stated under *Ferula Narthex*) was equally confident, as a result of his investigations, that they accorded with his *Narthex*.* But the specimens are fragmentary, and appear to us insufficient to decide the question with certainty; and since Kaempfer's figures† (as remarked by Hanbury) agree with neither, we have not thought it advisable to refer either of these two species to *F. Assafœtida*, Linn.

There is no doubt that the drug is afforded by other allied species of *Ferula* besides the two figured in this book. The *F. Assafœtida* of Hope, originally sent from Ghilan, Persia, by Pallas as the true Assafœtida plant, was first described and figured in the 'Philosophical Transactions' for 1784 (tt. 3, 4); it is *F. persica*, Linn. Hope's figures are copied in Woodville, t. 43, and the plant (also figured in Steph. and Ch., t. 169, and 'Bot. Mag.,' t. 2096) is still grown in botanical gardens.

The *F. Assafœtida* of Boissier and Bunge is a species growing in the districts of Khorassan and Kerman, in Persia, and is now called *F. alliacea*, Boiss. This species certainly yields an assafœtida; and according to Dymock the plant which affords that which is called by the name "Hing" in the Bombay market is to be referred to it. Dr. Dymock's plant is in cultivation at Kew, but has not, we believe, been figured. The *Dorema Assafœtida* of Loftus, collected by him on the banks of the

* Royle has figured the two mericarps in Kaempfer's herbarium in his 'Materia Medica,' ed. 2, p. 465.

† These are reproduced in Nees, t. 293.

Zenderud, Baktiyari Mts., Persia, is a close ally of *F. alliacea*, if not that species.

The Genus *Scorodosma* was by its author distinguished from *Ferula* by its calyx-rim, entire petals, and the absence of vittæ. As elsewhere observed, the last character is of little value. The authors of the 'Genera Plantarum,' whom we have followed in reducing the genus to *Ferula*, state indeed that vittæ are present, and can be seen with a strong lens; we have, however, failed to find the slightest trace of them in the fruits examined by us.

The plate has been inadvertently lettered "*Ferula fœtida*, Benth. & Hook. fil.," a name which has not been published by those authors; the error should be therefore corrected.

Kaempfer, Amœnitates Exoticæ (1712), p. 535; Bunge, in Mem. Sav. Etrang. Acad. S. Petersb., vii, p. 309, and in Linnæa, 1851, p. 157; Borszczow, in Mem. Acad., S. Petersb., ser. 7, iii (1860), p. 1; Boissier, Fl. Orient., ii, p. 994; Flück. and Hanb., Pharmacogr., p. 280; Schuyler, Turkestan, i, p. 228; Dymock, in Pharm. Journ., 1875, p. 945.

Official Part and Name. — ASSAFŒTIDA; a gum-resin obtained by incision of the living root of Narthex Assafœtida, *Falconer* (B. P.). Gum-resin obtained by incision from the living root of Ferula Asafœtida, *Linn.* (I. P.). ASSAFŒTIDA; a gum-resinous exudation obtained by incision from the root of Narthex Assafœtida, *Falconer* (U. S. P.).

Collection.—The mode of collecting Assafœtida, or as it is more generally called Asafœtida, as described by Kæmpfer, more than a century and a half ago, as witnessed by him on the mountains about Dusgun, in Laristan, in Persia, is as follows:—About the middle of April, when the plant has ceased to grow and its leaves are beginning to wither, the earth is removed around the upper part of the root, and the leaves and the fibres at its top are pulled off; after which the earth is replaced, and the whole covered by the leaves and other herbage, which are kept in their place by means of a stone laid over them, and so arranged as to

defend the root from being injured by the heat of the sun. About forty days later, that is, on the 25th of May, the collectors return, each being provided with a sharp knife to cut the root, a broad iron spatula to scrape off the juice, a cup fixed to the thigh to receive it, and two baskets hung over the shoulders upon a pole. The leaves, &c., and earth are then removed, a thin transverse slice is taken from the crown of the root, and two days later the juice which has exuded is scraped off from the flat cut surface, and put into the cups. A fresh transverse slice is then taken off, and the juice again scraped from the surface after the same interval; when the root is again cut and the juice removed in a like way and after a like interval. The roots are then left untouched for eight or ten days, when the operations are repeated during June and July, until the root is quite exhausted, which is commonly early in the latter month. After each operation, except that of the last, the root is sheltered from the sun by leaves, care being taken that nothing rests upon its cut surface. The contents of the cups are from time to time emptied into large vessels, and the juice exposed to the sun to become harder, when it is conveyed home in the baskets.

The product which is derived from the first incisions at the end of May is said to be thinner, more milky, and less valuable than that subsequently obtained in June and July. The first product is called *shir*, that is, *milk;* and the latter thicker exudation, *pispaz;* the former is mixed before being sold with an equal, or even double its weight of soft earth, according to its degree of softness. The mode of collecting Asafœtida has also been recently described by Staff Surgeon H. W. Bellew, in his 'Journal of a Mission to Afghanistan,' but it does not differ in any important particulars from that of Kæmpfer as given above. The quantity of gum-resin obtained from each root varies according to its size and other circumstances, from half an ounce to two pounds.

It will be seen that the plant now under description is not the official botanical source of asafœtida of either the British Pharmacopœia, the Pharmacopœia of India, or the Pharmacopœia of the United States, hence all details in reference to its Commerce,

General Characters, Varieties, Composition, Medical Properties and Uses, are given under Ferula Narthex, *Boiss.* (Narthex Assafœtida, *Falc.*), which is the official plant in those pharmacopœias.

Per. Mat. Med., vol. ii, pt. 2, p. 175; Pharmacographia, p. 282; U. S. Disp., by W. & B., p. 154; Royle's Mat. Med., by J. Harley, p. 595; Kæmpfer, Amœnitates Exoticæ, p. 535; Bellew, Journal of a Mission to Afghanistan, Lond., 1862, p. 270; Dymock, in Pharm. Journ., ser. 3, vol. v, p. 945.

DESCRIPTION OF PLATE.

(Erroneously lettered *Ferula fœtida*, Benth. & Hook. f.). Drawn from a specimen in the Museum of Economic Botany, Kew; the flowers and base of stem added from Borszczow.

1. Upper portion of a whole plant in fruit ($\frac{1}{6}$ natural size).
2. A single umbel.
3. Dorsal, and—4. Commissural view of a mericarp.
5. Transverse section of the same.
6. Umbellule of male flowers.
7. Umbellule of female flowers, some abortive.
8. A male flower.
9. An abortive flower.
10. A female flower.
11. A very young fruit.
12. Transverse section of the same.
13. Base of stem, showing root-leaves and root (about $\frac{1}{12}$ nat. size).

(3–5, 8–12 enlarged.)

FERULA TINGITANIFLORA, *Boiss. & Reut.*

N. Ord. UMBELLIFERÆ.
Tribe *Peucedaneæ*.
Genus Ferula, *Linn.*

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128. Ferula galbaniflua, *Boiss. & Buhse in Nouv. Mém. Soc. Imp. Nat. de Moscou,* xii, *p.* 99 (1860).

Kassnih, Boridscheh (Persia).

Syn.—F. gummosa, *Boiss.* (1856). F. erubescens, *Boiss.* (1844), in part.

Not previously figured.

Description.—Root large, thickened below the neck, branched, sparingly filled with resinous juice. Stem 4 or 5 feet high, erect, an inch or more in diameter at the base, branched above, terete, striate, solid, exuding a white gum-resin which quickly becomes yellow on exposure to the air. Root-leaves 1½—2 feet long, with a slightly sheathing base and long petiole, greyish, covered with a fine down, outline broadly triangular, very compound ; the primary divisions 3, on very long stalks, rhomboidal in outline and bipinnate, with the pinnæ opposite and distant, ultimate leaflets very small, not ½ an inch long, ovate, pinnatifid or bipinnatifid, with the segments linear, bluntish, divaricate, entire, and more or less collected into a bunch ; cauline leaves reduced to a very small multifid tufted limb terminating an oblong, acute, membranous, veined, tomentose, not swollen, sheathing petiole, deciduous. Flowers polygamous ; umbels of fertile flowers terminal, those of male flowers lateral, on long stalks which overtop the fertile umbel; rays 6—14, thickened at both ends, pedicels slender, general involucre absent, partial either absent or represented by a few small lanceolate bracts. Calyx-segments obsolete. Petals linear-lanceolate, rather acute, entire, with an incurved apex, pale yellow, smooth. Filaments long. Fruit on stalks about ⅕ of an inch long, greatly compressed, elliptic-oblong or slightly obovate in outline, blunt at both ends, ½ to nearly ¾ of an inch long, ¼ to nearly ⅜ wide, crowned with

the short stiffly reflexed styles, mericarps surrounded by a thin flat wing, varying in width from not more than $\frac{1}{6}$ to quite $\frac{1}{4}$ the whole width of the fruit, greyish-yellow, smooth, ribs very slender, prominent, vittæ solitary in each groove, wide, swollen, in the commissure either absent,* or more frequently two, small and narrow. Embryo small, with ovate blunt cotyledons. (We have not seen the flowers, the above description of them is taken from the writings of M. Boissier, quoted below.)

Habitat.—This plant was originally found by Dr. Buhse in 1847 or 1848 at the foot and on the slopes, between 4000 and 8000 feet, of Demavend, a mountain to the north-east of Teheran, Northern Persia, and on the neighbouring hills at Kuschkäk and Churchurä, flowering and fruiting in June. What is considered by Boissier to be the same plant was also collected in 1858 by Bunge, near Sebsewar, between Schahrud and Nischapur, in Khorassan. This latter, of which we have seen only ripe fruit and dry stems, appears to be more robust than Buhse's plant, from which it also slightly differs in the larger and more orange-coloured mericarps, which are rather obovate and twisted, and possess a wider wing and invariably (?) 2 narrow vittæ in the commissure; the specimens are covered with the exuded yellow gum-resin abundantly. For examples of both plants we are indebted to the courtesy of M. Boissier, of Geneva.

Ferula rubricaulis, Boiss., is, according to Borszczow, also a source of Galbanum. This plant has been collected in the Kuhdaëna mountains of South Persia by Kotschy, and in Dalmkuh in Northern Persia by Aucher-Eloy, and, no doubt, occurs elsewhere in the same country. It is drawn from authentic specimens in Berg and Schmidt's work, t. 31 b, under the name *F. erubescens*, Boiss. Boissier places it in a different section (*Scorodosma*) of the genus *Ferula* to the plant above described, in consequence of the vittæ being indistinct and numerous instead of solitary in the grooves; the petals are also somewhat broader, oblong-ovate or oval. Borszczow, on the contrary, unites the

* M. Boissier describes the commissure as without vittæ in this species; but this is far from constantly the case in the fruits examined by us.

two, and they are certainly very nearly allied. Indeed, Boissier's discarded species, *F. erubescens*, was made up of specimens some of which he now refers to *F. rubricaulis* and others to *F. galbaniflua*, var. β. *Aucheri*. This latter variety, collected in Persia by Aucher-Eloy (no. 3658), though it certainly has the vittæ of the species to which it is now referred, possesses leaves with the wider segments of *F. rubricaulis*, as figured in Berg's plate. It was to Aucher-Eloy's plant that the name *F. gummosa* was formerly given by Boissier.

These two plants no doubt afford the great bulk of Persian Galbanum, but *Ferula Schaïr*, Borszczow, a native of the desert regions of the Syr-Darja (River Syr), on the confines of Siberia and Turkestan, is also a source of the drug. It was met with in 1859 near Lake Kotschkan-Ssu, and is said to grow abundantly about 3 miles further eastward. A tenacious milky juice was observed to exude from the cut stem which had completely the odour of Galbanum, and the scent was so strong as to be observed at a considerable distance. This plant is finely illustrated in Borszczow's memoir quoted below, tt. 6—8.*

The *Galbanum officinale* of Don (Trans. Linn. Soc., xvi (1833), p. 603), founded on fruits sticking to the drug, cannot be certainly determined. The fruits were clearly not those of the Galbanum plant, and are thought by Bentham to come near *Polylophium*. Lindley's *Opoïdia galbanifera*, collected by Sir J. McNeill in Khorassan in 1838 (Bot. Register, 1839, app. p. 66), has not been identified, but is considered by the same authority to be probably some species of *Peucedanum*.

Buhse, in Bulletin Soc. Imp. Nat. de Moscou, xxiii (1850), p. 548, and Nouv. Mém. Soc. Imp. Nat. Mosc., xii (1860), p. 99; Boissier, in Ann. des Sc. Nat., ser. 3, i, p. 316, Diagnoses Plant., nov. Or., ser. 2, fasc. 2, p. 92, and Flora Orientalis, ii, pp. 989 and 995; Borszczow, in Mem. Acad. Imp. Sciences, St. Petersbourg, iii (1860-61), p. 33.

Official Part and Names.—Galbanum; a gum-resin, derived from an unascertained umbelliferous plant (B. P.). A gum-resin

* Bentham & Hook. f. (Gen. i, p. 920) refer it to *Peucedanum* (sect. *Diplotænia*).

from Ferula galbaniflua, *Buhse* (I. P.). GALBANUM; the gum-resin of an undetermined plant (U. S. P.).

Collection and Commerce.—According to Geoffroy, galbanum is usually obtained by making an incision into the stalks a little above the root, from which it issues in a fluid state in drops, but in a few hours it becomes dry and hard enough to gather. Landerer also says that it is obtained by making an incision into the plant, under which a mussel shell is placed to collect the juice as it exudes. E. Hirschsohn in a recent memoir, from the fact that most kinds of commercial galbanum contain pieces of root, likewise expresses his belief that it is obtained by incision of the root, and collection of the exuded juice after it has hardened. Buhse, however, states that the inhabitants of the district he visited, do not incise the plant at all, but that the juice, which is milk-white in colour, exudes spontaneously from the stem, particularly near its base, and at the points of insertion of the leaves. The juice soon concretes into tears, which are at first milk-white like it, but ultimately, by exposure to light and air, assume a yellow colour. It seems probable, therefore, that the collection may vary in different districts.

Some galbanum is stated to be exported by way of Bombay; but it is principally obtained from the Levant, and a large quantity is said by Ludwig to reach Russia by Astrachan and Orenburg, or according to Goebel by Nishnei-Novgorod and Astrachan. That which comes to us by way of Bombay and the Levant is the ordinary kind seen in this country, and is considered by Martiny to be a distinct variety from that which reaches Russia by Astrachan. The former he terms Levant Galbanum, the latter Persian Galbanum.

General Characters, Varieties, and Composition.—The ordinary Galbanum, which is sometimes known as Levant Galbanum, is found in commerce in the two forms of tear and mass; the latter variety being by far the more common. *Galbanum in tear* occurs in distinct roundish or irregular-shaped tears, which vary in size from a lentil to that of a hazel nut, although rarely exceeding

that of a pea; the tears are of a light yellowish-brown, orange-brown, or yellowish-green colour; more or less translucent, usually rough on their surface, hard and brittle in cold weather, but softening in summer, and by the heat of the hand becoming ductile and sticky. The tears are frequently found in a more or less agglutinated state. *Galbanum in mass* usually occurs in large, hard, compact, irregularly-shaped masses, which are commonly of a yellowish-brown or dark brownish-yellow colour, or occasionally they have a greenish tint; these masses are composed of more or less agglutinated tears, and generally contain a variable proportion of the fruits of the galbanum plant, with pieces of the root, stem, and other impurities. Galbanum is separated from its impurities by being melted and strained. In rare cases galbanum is found in a soft, almost fluid state. This latter, which is sometimes regarded as a distinct kind under the name of Persian Galbanum, has a strong peculiar odour, which has been supposed to have some resemblance to a mixture of garlic and savin; and a disagreeable, bitter, somewhat acrid and alliaceous taste.

Galbanum contains about 60 per cent. of *resin*, 33 of *gum* or *mucilage*, and 7 of *volatile oil*; it is therefore a *gum-resin*. The *resin* has a soft consistence, and is soluble in ether or alkaline liquids; it yields by the action of heat and hydrochloric acid, nearly 1 per cent. of the substance termed *umbelliferone*, which may be separated from the acid solution by means of ether or chloroform in which it is soluble; and by subsequent evaporation of these solutions it can be obtained in colourless crystals of an acicular form. *Umbelliferone*, as is noticed in treating of assafœtida and ammoniacum, is also obtainable in small proportion from these drugs. Umbelliferone is likewise soluble in water, and the solution displays a blueish fluorescence, which is rendered much more manifest by the addition of an alkali, but is destroyed by an acid. That umbelliferone exists pre-formed in galbanum is proved by the blue fluorescence being at once evident when a drop of ammonia is added to water in which a piece of galbanum has been immersed for a short time. Amongst other substances also obtainable from galbanum resin, may be mentioned a thick

oil of an intensely blue colour, and which is said to be identical with the blue oil derived from the flowers of *Matricaria Chamomilla*, L.; and *resorcin*. It is probably from the formation of this latter substance that galbanum, or its resin, develops a red colour when warmed with concentrated hydrochloric acid. By this test galbanum may be distinguished from both assafœtida and ammoniacum, for, according to Flückiger and Hanbury, when assafœtida is treated in the same way, it "assumes a dingy greenish colour, and ammoniacum is not altered at all." The *volatile oil of galbanum* is a colourless dextrogyrate liquid, with the odour of the drug, and boiling at a temperature of from 320° to 329°. Nothing definite is known of the gum or mucilage of galbanum; it is said to be perfectly similar to gum arabic.

Medical Properties and Uses.—In its action galbanum is intermediate between assafœtida and ammoniacum, but it is much less used than either of these gum-resins. As an antispasmodic it is far less powerful than assafœtida; but in its stimulating expectorant properties it is allied to ammoniacum. It is frequently given in combination with assafœtida, as in the official compound assafœtida pill, which possesses stimulant and antispasmodic properties, and is useful in hysteria, chlorosis, &c. Galbanum has also been regarded as a useful internal remedy in chronic mucous catarrh, in amenorrhœa, and chronic rheumatism. It is applied externally in the form of galbanum plaster, as a mild stimulant in promoting the resolution or suppuration of indolent tumours; and to the chest in chronic pulmonary affections.

Galbanum entered into the composition of the incense in use by the ancient Jews, and is still employed for a similar purpose by the Catholic Apostolic Church.

Exodus xxx, 34.

Per. Mat. Med., vol. ii, pt. 2, p. 188; Pharmacographia, p. 286; U. S. Disp., by W. & B., p. 413; Geoffroy, Trait. de Mat. Med., vol. ii, p. 623; Buhse, in Bulletin. de la Soc. Imp. des Nat. de Moscou, vol. xxiii (1850), p. 548, and in Ph. Jl., vol. xi, ser. 1, p. 577; Gmelin's Chemistry, vol. xi, p. 228; Pharm. Jl., vol. iii, ser. 2, p. 428; Hirschsohn, in Pharm. Jl., vol. vii, ser. 3, pp. 369, 389, and 429.

DESCRIPTION OF PLATE.

Drawn from a specimen collected by Buhse in Persia (no. 1137), kindly communicated by M. Boissier.

1. Umbel of ripe fruit, with withered umbels of barren flowers.
2. A fruit.
3. Back, and—4. Commissural face of a mericarp.
5. Section of a mericarp.
6. One of the three primary divisions of a lower leaf.
7. An ultimate leaflet.

(3, 4, 5, 7 enlarged.)

D.B. ann. F.L.S. ad nat. del. et lith.

M&N Hanhart imp.

FERULA SUMBUL, *Hook fil.*

N. Ord. UMBELLIFERÆ.

Tribe *Peucedaneæ*.

Genus **Ferula**, *Linn.*

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131. Ferula Sumbul,* *Hook. fil., in Bot. Mag.*, t. 6196 (1875).

Sumbul.

Syn.—Euryangium† Sumbul, *Kauffmann.*

Figures.—Nouv. Mém. Soc. Imp. Nat. de Moscou, xiii, tt. 24, 25; Bot. Mag., t. 6196 (bad).

Description.—A herbaceous perennial of limited duration, (always ?) dying after flowering. Root large, cylindrical, reaching a diameter of 4 or 5 inches, short and divided below into several long descending branches, solid, covered externally with a dark brown tranversely wrinkled rind, crowned by the fibrous remnants of the petiole-sheaths of previous years. Flowering stem erect, over 8 feet high, slender, nearly straight, cylindrical, solid, about $1\frac{1}{4}$ inch diameter at the base, perfectly glabrous, purplish, exuding a milky latex when injured, with about 12 long, stiff, slender, divaricate branches in the upper half. Root-leaves large, about $2\frac{1}{2}$ feet long, with short channelled petioles, which are much dilated and completely surround the stem at their insertion; triangular in outline, tripinnate, the primary and secondary pinnæ opposite, stalked, triangular, leaflets opposite, more or less ovate in outline, but very deeply divided into rather distant wedge-shaped segments, which are irregularly cut into oblong, often toothed divisions, smooth, flat, bright green; the stem-leaves few, near the base, much smaller, and at length reduced to sheathing bracts above. Flowers polygamous; umbels of bisexual flowers terminating the branches, male umbels lateral; umbels all stalked with a large, scarious, amplexicaul, semi-transparent, reddish-brown bract at the base of each stalk

* *Sumbul*, a Persian and Arabic word applied to various roots.

† Ἐυρύς, broad; and ἀγγεῖον, a reservoir; from the large vittæ of the young fruit.

and usually several smaller ones upon its lower part, primary rays 10 to 15, the outer ones a little deflexed, thickened at both ends, smooth, terete, shining; no involucre. Male flowers :—calyx-limb absent; petals 5, small, strap-shaped, with a long strongly incurved tongue, reduplicate along the prominent midrib, dull pale pink; stamens longer than the petals; ovary and styles quite rudimentary; epigynous disk large, thick, soft, circular, overhanging the insertion of the stamens and petals. Hermaphrodite flowers :—calyx with 5 minute teeth; petals and stamens as in the male; disk much expanded with 8 undulated lobes at first horizontal, but afterwards erect forming after the fall of the stamens and petals a crown, or even folding over on itself, styles short, erect or slightly recurved, on a prominent conical stylopod; ovary broadly oblong-ovoid, smooth, nearly circular on section, which exhibits 8 very large somewhat quadrangular dorsal vittæ, 4 in each mericarp, separated by very thin partitions, and filled with a milky fluid, and 4 commissural vittæ (2 in each mericarp) narrower and filled with a solid secretion. Fruit $\frac{3}{8}$—$\frac{1}{2}$ inch long by $\frac{1}{4}$ inch wide, mericarps oblong-oval, very much dorsally compressed, thin, somewhat curved or contorted, the 3 dorsal ridges very faint and threadlike, the lateral ones expanded into a thin, narrow, dorsally convex wing, smooth, pale orange-brown; dorsal vittæ quite invisible (no trace of them discernible in the fruits examined), commissural ones collapsed, but their position plainly indicated by two dark brown tracts on the commissural surface.

Habitat.—This plant was discovered in the summer of 1869 by Fedschenko in the mountains to the south-east of Samarkand (which form the present boundary of the Russian Empire, separating Russian Turkestan from Bucharia), near the small town of Pentschakend on the River Zarafshan, at an elevation of 3000—4000 feet. A root was sent to the Moscow Botanical Gardens, where it flowered in 1871 and formed the subject of the memoir by Kauffmann quoted below.

In 1872 two dry roots were received at Kew from the Moscow Garden, one of which had fortunately retained its vitality. This

threw up root-leaves each year, and in 1875 produced a fine flowering stem which grew vigorously and bore numerous umbels, the leaves withering away; unfortunately although the ovaries commenced to increase in size, they withered off and no fruit was formed. After flowering the plant died.

The genus *Euryangium* was based by its author on the very large solitary dorsal vittæ, which in the ovary occupy by far the greater part of it. These are filled with copious latex which pours out on a section being made and has a very strong odour of musk, especially if treated with water. In the absence of ripe fruit, this character might have been held sufficient perhaps to sustain the generic distinction, but an examination of some ripe mericarps kindly communicated from the Moscow Herbarium by M. Tchistiakoff has convinced us that the plant should be referred to *Ferula* of which it has altogether the habit and general characters. The complete (?) collapse of these great vittæ in the mature fruit is, indeed, very remarkable, and is a further striking example of the difficulty of employing these organs as a means of grouping the oriental Feruloid Umbelliferæ.

The minute anatomical structure of Sumbul root has been investigated by Tchistiakoff; and an Italian translation of his paper (originally in Russian) will be found referred to below; the memoir is illustrated by two plates.

Wittmann has recently ('Pharm. Zeitsch. f. Russland,' xv, p. 545, abstracted in 'Pharm. Journ.,' 1876, p. 329) stated that the sumbul is abundant near Chabarowka in the province of Küsten, East Siberia, where it is called Ouchi or Ofnokgi by the inhabitants. But from his description of the plant it seems that he may intend some other Umbellifer than that above described.

The plant brought from Turkestan by Severzow as the mother-plant of Sumbul-root, *Hyalolæna Severzovii*, Regel & Herder ('Bull. Soc. Imp. Nat. Moscou,' xxxix (1866), p. 114), is an Umbellifer, but quite distinct from the present species.

Kauffmann, in Nouv. Mém. Soc. Imp. des Nat. des Moscou, xiii (1871), p. 253; Tchistiakoff, in Nuovo Giorn. Bot. Italiano, v (1873), p. 298; Trimen, in Journ. Bot. 1875, p. 275; Flück. & Hanb., Pharmacogr., p. 278.

Official Part and Name.—Sumbul Radix; the dried transverse sections of the root of a plant the botanical history of which is unknown (B. P.). The dried root (I. P.). It is not official in the Pharmacopœia of the United States.

Varieties and Commerce.—Two varieties of Sumbul root have been described by Pereira as having appeared in English commerce, namely, Russian and Indian; the former, as its name implies, being derived from Russia, and the latter is imported into England from Bombay. In the British Pharmacopœia, and also in the Pharmacopœia of India, Sumbul root is likewise stated to be imported from Russia and from India. Pereira also states that Sumbul root has been brought to England *via* China, and he conjectured that this Sumbul was identical with the Indian variety. At the present day, however, all the Sumbul root which reaches Europe or the United States is imported from Russia.

General Characters and Composition.—Sumbul as now found in commerce is in roundish pieces, which are transverse sections of the root. These pieces vary commonly from about 1½ to 3 inches, although rarely they may be found as much as 5 inches, in diameter; smaller pieces may also be met with mixed with the larger slices. They vary in thickness from about three fourths of an inch to an inch and a half, although, in rare cases, pieces not thicker than a common quill may be found. On the outer surface the pieces are covered with a dusky, light brown, transversely-wrinkled, papery bark, and in the case of those derived from the crown of the root they are beset with short bristly fibres. The interior structure is spongy, coarsely fibrous, dry, and farinaceous-looking; the colour is yellowish-brown, mottled with whitish patches, and when the surface is examined with a lens it presents, particularly towards the circumference, an abundant resinous exudation. Sumbul root has a strong, pleasant, musky odour, which it retains after being long kept; hence the name of *musk-root* by which it is frequently designated. Its taste is at first feebly sweetish, but it soon becomes bitterish and aromatic.

The above characters apply especially to the sumbul root as now found in commerce, and which corresponds with the Russian

Sumbul of Pereira. The Indian Sumbul of that author is stated to be "of closer texture, firmer, denser, and of a more reddish tint than the Russian sort," and perhaps of less powerful odour.

Dried sumbul root yields about 9 per cent. of a *balsamic resin*, a very minute quantity of *volatile oil*, about three fourths per cent. of a crystallizable acid called *sumbulic* or *sumbulolic acid*, a little *umbelliferone*, a substance which is alluded to in our description of galbanum, *starch*, and other unimportant constituents. The *resin* is soft, soluble in ether, and of a musky odour, which is rendered more evident by contact with water; it is converted by the action of solution of potash into *sumbulamic acid*, which forms a crystalline salt with it. This acid is said by Reinsch to be a crystalline body, and to have a strong smell of musk. It is in this resin that the activity of sumbul root appears essentially to reside. But little is known of the volatile oil, or of sumbulic acid; but the latter is stated by Ricker and Reinsch to be nothing more than *angelic acid*, associated with a trace of *valerianic acid*. A substance called *sumbulin* has also been stated by Murawieff to be a constituent of sumbul root. All the above constituents require further examination.

Medical Properties and Uses.—Sumbul is usually regarded as a nervine stimulant like valerian, and as an antispasmodic; but its action requires further investigation. It was first introduced into Russia as a substitute for musk, and highly recommended as a remedy in cholera. It has also been employed, chiefly in the form of tincture, as a remedy in low typhoid fevers, delirium tremens, chronic pulmonary affections, asthenic cases of dysentery and diarrhœa, in various nervous affections, such as hysteria, chorea, epilepsy, and spasmodic asthma, and in other diseases. Dr. Murawieff of Russia has recommended the use of the resin in the dose of a grain or two in the form of pill, in hysteria, &c.

Per. Mat. Med., vol. ii, pt. 2, p. 208; Per. Mat. Med., by B. & R., p. 754; Pharmacographia, p. 278; U. S. Disp., by W. & B., p. 849; The Sumbul, a New Asiatic Remedy, by A. B. Granville, M.D. Lond., 1850; Pharm. Journ., ser. 1, vol. xi, p. 358,

and Amer. Journ. Pharm., vol. xxiv, p. 174; Journ. de Pharm., vol. xix, p. 278, 1851; Murawieff, in Dub. Quart. Journ., Feb., 1855, p. 352, from Med. Zeit. Russland; Year-Book of Pharmacy for 1875, p. 191.

DESCRIPTION OF PLATE.

Drawn from the plant flowering in Kew Gardens in 1875; the ripe fruit from specimens kindly sent by Prof. Tschistiakoff from the herbarium of the Imperial Botanic Garden, Moscow; the root added from Kauffmann.

1. The plant in flower ($\frac{1}{12}$ the natural size).
2. A lateral branch with umbels.
3. A male flower.
4. Vertical, and—5. Transverse section through ovary.
6. Partially ripened ovary.
7. Back, and—8. Commissural view, and—9. Transverse section of a mericarp of the same.
10. Portion of a leaf.
11, 12. Dorsal, and—13. Commissural surface of a ripe mericarp.
14. Transverse section of the same.
15. Root.

(3–9, 12–14, enlarged.)

D. Ammoniacum, *Don.*

DOREMA AUCHERI, *Boiss*

N. Ord. UMBELLIFERÆ.

Tribe *Peucedaneæ*.

Genus **Dorema**, *D. Don.** B. & H., Gen. i, p. 918; Boissier, Fl. Orient., ii, pp. 1008—1010. Species 4, natives of the East.

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129. Dorema Aucheri,† *Boissier in Ann. des Sc. Nat., ser.* iii, *p.* 329 (1844).

Zuh (Kurdish). *Weshek* (Persian).

Syn.—D. Ammoniacum, *Loftus, MS., non D. Don.*

Not previously figured.

Description.—A tall, upright plant, 6—8 feet high. Stem cylindrical, stout, glabrous, solid, faintly striate. Leaves (all radical ?) very large, over 2 feet long, bi- or tripinnate, long-stalked, the petioles and branches nearly cylindrical or sub-triangular, solid, striate, the pinnæ given off in pairs from the upper surface, and projecting upwards and outwards, general outline of leaf when flattened out broadly triangular, the lower pinnæ much the largest, and each pair gradually diminishing in size, leaflets oblong-oval, bluntish or sub-acute at the apex, attenuated and frequently more or less decurrent at the base, rather thin, glabrous or very minutely pilose at the base, entire. Flowers hermaphrodite or male, the two kinds separately arranged in small, simple, globose, stalked umbels; umbels of hermaphrodite flowers very laxly arranged in imperfect whorls or clusters upon long, usually simple, cylindrical, smooth, tapering, spreading branches, 12—18 inches long; umbels of male (barren) flowers more numerously crowded on slender divaricate branchlets, which are arranged in whorls on the thick primary branches. Hermaphrodite flowers; limb of the calyx quite absent, no sign of the teeth being present, petals ovate, thin, with a strongly marked mid-rib, yellow, the

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* *Dorema*, δώρημα, a gift, from the value of its product.

† Aucher-Eloy, the celebrated oriental traveller, died at Ispahan in 1838.

apex elongated, acute, doubled over on the petal; stamens spreading, filaments more than twice as long as the globose anthers, epigynous; ovary inferior, quite smooth, nearly circular on section, the edges of the component carpels somewhat prominent, epigynous disc large, projecting considerably beyond the top of the ovary, conical, lobed at the margin, styles tapering, slightly spreading. Barren flowers: petals considerably smaller, ovary and styles entirely absent, disc smaller, flat, lobed, filaments shorter, anthers as in the hermaphrodite flowers. Fruit $\frac{3}{8}$—$\frac{1}{4}$ inch long, by about $\frac{1}{5}$ wide, on longish divaricate stalks, oblong-oval in outline, brownish or greyish-yellow with pale ribs, styles persistent, reflexed, mericarps much dorsally compressed, pericarp very thin and papery, readily separating from the seed, commissure very nearly flat, dorsal and intermediate primary ribs filiform, faintly marked, lateral ones thickened, forming a narrow sharp border to the mericarp, vittæ quite absent.

D. robustum, Loftus, is referred by Boissier to this species. The fruit (which is all the material in the British Museum) is considerably larger than that of *D. Aucheri*, pale orange-coloured, with more prominent ribs, and without the reflexed style, but is otherwise similar. The gum bears no similarity to Ammoniacum.

Habitat.—This species of *Dorema* appears to have a wide range in the western provinces of Persia and the neighbourhood of Ispahan. Our knowledge of it is mainly from the description of Boissier, but the large series of excellent specimens brought home by Mr. W. K. Loftus, who collected them in 1851-52, has enabled us to considerably supplement Boissier's account. Were it not for the complete absence of vittæ in the commissure the plant of Loftus would fall under *D. glabrum*, F. & M., as the leaves are almost always glabrous, but the character is one of but slight importance, and the species might be, perhaps, combined. The peculiar polygamy of the flowers has been not previously observed in the genus; the great masses of many hundred umbels in the barren inflorescence must give the plant a very characteristic appearance. Loftus gives no information in

his published 'Travels' about this, or indeed about any of the plants he brought back. The plant flowers in June.

Boissier, Fl. Orientalis, ii, p. 1009; Flük. & Hanbury, Pharmacographia, p. 289.

Official Part and Name.—AMMONIACUM; a gum-resinous exudation from Dorema Ammoniacum, *Don.* (B. P.). The gum-resinous exudation from the stem (*Ammoniacum*) (I. P.). AMMONIACUM; a gum-resinous exudation from Dorema Ammoniacum, *Don.* (U.S. P.).

It should be noticed here that the ammoniacum now used in medicine, or *Persian Ammoniacum*, is not the ammoniacum of Hippocrates, Dioscorides, and Pliny, which was employed for fumigation. The latter, which was derived from Africa, and may be distinguished therefore as *African Ammoniacum*, was, according to Lindley, "certainly the produce of *Ferula tingitana*." This kind of ammoniacum is still collected in Morocco, and forms an object of traffic with Egypt and Arabia, and Dr. Leared has lately obtained some roots of the plant from Morocco, which have been planted in the Botanic Gardens at Kew and Regent's Park, so that it is hoped that its botanical origin, which has been questioned, may be soon conclusively ascertained.

It should be also noticed that the plant now under description is not the recognised botanical source of ammoniacum of either the British, Indian, or United States Pharmacopœia. But that *Dorema Aucheri* does afford very good ammoniacum may be seen by examining the gum-resin yielded by it which is preserved in the British Museum. The tears are in this somewhat smaller, and the surface of the resin darker in colour than in the ordinary lung. As it is not, however, the official plant, our notice of the Collection, Commerce, Composition, General Characters, Medical Properties, and Uses of Ammoniacum, is given under *Dorema Ammoniacum*.

Pharmacographia, p. 289; Per. Mat. Med., vol. ii, pt. ii, p. 184; Hanbury, in Pharm. Journ., March 22, 1873, p. 741; Moss, in Pharm. Journ., March, 1873, pp. 742 and 761.

DESCRIPTION OF PLATE.

Drawn from specimens in the British Museum, collected by Loftus in Lauristan, Persia.

1. Upper part of a lower (radical?) leaf.
2. Branch of the fertile inflorescence.
3. Hermaphrodite flower.
4. Small portion of the male inflorescence.
5. Male flower.
6. Ripe fruit.
7. A mericarp, dorsal view.
8. The same, commissural surface.
9. Transverse section of fruit.
10. Vertical section of a mericarp.
11. Embryo.
12. *Dorema Ammoniacum*, Don. Whole plant about $\frac{1}{16}$ natural size, reduced from Borczcow's plate (Mem. Acad. Petersb., 1861, t. 3).

(3, 5, 7—10 enlarged; 11 greatly magnified.)

DORSTENIA AMMONIACUM Mirb.

N. Ord. UMBELLIFERÆ.

Tribe *Peucedaneæ*.

Genus **Dorema**, *D. Don.*

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130. Dorema Ammoniacum,* *D. Don in Trans. Linn. Soc. Lond.*, xvi, *p.* 602 (1833).

Ooshāk (Persia). *Kandal* (Bucharia). *Bal-kurai* (Kirghiz).

Syn.—Diserneston† gummiferum, *Jaub. & Spach.* Peucedanum? Ammoniacum, *Nees & Eberm.*

Figures.—Jaubert & Spach, Ill. Pl. Orient., t. 40 (bad); Borszczow, in Mém. Acad. Imp. Sc. St. Petersb., sér. 7, iii, tt. 3—5, partially cop. in Berg & Sch., t. 26 c, e; Berg, Characterist., t. 58, fig. 443.

Description.—A large herbaceous plant enduring for several years and described as perennial but probably dying after flowering, with a large cylindrical, somewhat fusiform root branched below. Stem 5 to 7 feet high, erect, straight, cylindrical, stout, gradually tapering, 3 or 4 inches in circumference at the base, striate, pale green, tinged with lake at the joints or purplish, solid, the upper part covered when young with a fine white down which is easily detached, afterwards all quite glabrous and rather shining, with about 12—16 rather short (about a foot long) erect, tapering branches in the upper half, gradually shorter and thus forming a narrow pyramidal head. Leaves few, the radical ones about 4, long-stalked, the petioles dilated into a sheath which nearly surrounds the stem, large, 1½—2 feet long, bi- or tripinnate, the form much as in *D. Aucheri*, but the leaflets usually somewhat broader, thicker, and densely covered, as is also the petiole and its divisions, with minute, readily detached stellate white down; stem-leaves 3 or 4, reduced to large but close, amplexicaul pale sheaths, much elongated and usually reflexed at the

* *Ammoniacum*, the classical name, but originally applied to the gum resin of another plant, probably *Ferula tingitana*, L. The plant was thought by Dioscorides to grow near the temple of Jupiter Ammon in Libya.

† *Diserneston* was given in honour of two eminent French botanists, MM. E. Cosson and E. Germain de St. Pierre. the name of both being Ernest.

extremity which occasionally bears a small blade. Flowers (not seen) very small, sessile or nearly so, arranged in simple heads or umbels (the central ones usually barren) and more or less immersed in dense white cottony wool; heads numerous, scarcely ½ inch in diameter, globose, on short divaricate peduncles about ¼ inch long with a small bract at the base and placed rather distantly and irregularly in a racemose manner on the branches and terminal portion of the stem; involucre none, or of one or two minute linear bracts. Calyx-teeth rudimentary. Petals ovate with an entire, obtuse, inflexed point, white, the midrib hairy on the back. Stamens spreading, the filaments longer than the petals. Ovary densely woolly, stylopod conical, slightly lobed, styles erect, short. Fruit very shortly stalked, spreading, about ⅓ inch long, oval, much compressed, more or less covered with deciduous woolly down or nearly glabrous, crowned by the short reflexed styles, mericarps often twisted, pale brown, dorsal ridges filiform, marginal ones forming a narrow border, yellow, vittæ solitary in each groove and two narrow ones in the commissure.

Habitat.—Though this plant was not formally named and described till 1833, it had been partially known to botanists for some years previously. Col. Johnson in 1817 found the Ooshāk plant very abundant in the vicinity of Yezdekhāst a small town in S. W. Persia (the ancient Parthia) about 45 miles south of Ispahan, and has given a fair non-botanical description in his 'Journey.' Specimens (leaves and young fruit) collected by Mr. J. Dow at the same place in 1822 are in the British Museum. It was no doubt from this material that Robert Brown obtained his knowledge of the plant which enabled him in 1824 to give the information published by Mérat and De Lens in their 'Dictionnaire Universel.' Though recognising it as a new genus, however, Brown never published a name.

The paper of D. Don which was read before the Linnean Society in 1830 was based upon specimens collected by Col. Wright, R.E., near the same town, where the plant must be very plentiful, and grows exposed to the full glare of the sun on the

very dry, gravelly or stony plains. Several other travellers have collected it here, where Aucher-Eloy also found it; one of his specimens was in 1842 figured by Jaubert and Spach under the name of *Diserneston gummiferum*. The plant is, however, by no means confined to this locality, which, indeed, appears to be the south-western limit of its distribution. Thence it extends to Shahrud in northern Persia through Kohistan and Khorassan and stretches eastward to Herat, where, at Gorian, Sir J. McNeill collected it in 1839, and where it grows at an elevation of 4000 feet, and northward to the arid wastes lying south of the Sea of Aral, as far north as 45° lat., near the Syr Darya or Xaxartes River; from this last district were obtained the flowering specimens from which Borzszcow's descriptions and figures were made. *D. soongoricum*, Kar. & Kir., found by Karelin and Kiriloff near Sassyk Pastan in Songaria appears to be the same.

The flowers are produced in May, and by July the leaves have turned yellow and dry and the fruit is ripe; the tall thick stems long remain conspicuous objects after they are dead. The abortive fruits in the centre of the heads are small, ovoid, hard, 2-celled bodies, not compressed, densely covered with white wool.

What may be the *D. hirsutum*, "Loftus" quoted in Borzszcow (l.c., p. 28) we have no means of knowing, as we can find no specimen with that name in the British Museum. *D. odoriferum*, Loftus in Borzszcow, is *Ferulago Carduchorum*, Boiss. & Haussk.

T. Johnson, Journey from India to England (1818), p. 93; Mérat & De Lens, Dict. Univ. de Mat. Méd. (1829), i, p. 252; D. Don, in Trans. Linn. Soc. Lond., xvi, p. 599; Ledebour, Fl. Rossica, ii, p. 306; Jaubert & Spach, Ill. Plant. Orient., i, p. 78; Borzszcow, in Mém. Acad. Imp. Sc. St. Petersb., ser. 7, iii, p. 27; Boissier, Fl. Orient., ii, p. 1008; Lindl., Fl. Med., p. 47; Hirschsohn, in Pharm. Zeitsch. f. Russland, April 1875, transl. in Pharm. Journ., Jan., 1877, p. 612.

Official Part and Name.—AMMONIACUM; a gum-resinous exudation (B. P.). The gum-resinous exudation from the stem (I. P.). AMMONIACUM; a gum-resinous exudation (U. S. P.).

Collection and Commerce.—The whole plant is impregnated with milky juice which, at a certain period, exudes on the slightest

puncture; this, when hardened, constitutes ammoniacum, or, as it is sometimes termed, ammoniac. Ammoniacum of commerce, notwithstanding some statements to the contrary, appears to be derived entirely from the stem, and its exudation is caused by the puncture of beetles, and not by artificial incisions, as has been also sometimes stated. Lieut.-Col. Kennett says "When the plant has attained perfection, innumerable beetles, armed with an anterior and posterior probe of half an inch in length, pierce it in all directions; it (ammoniacum) then exudes, but soon becomes dry, and is then picked up and sent, *viâ* Bushire, to India and various parts of the world." In the Museum of the Pharmaceutical Society of Great Britain there is preserved a portion of the stem with lumps of ammoniacum sticking to it. This specimen was brought from Persia by Sir J. McNiell for Dr. Lindley, by whom it was given to Dr. Pereira, and was ultimately presented to the Pharmaceutical Society. As the juice exudes and hardens, the ammoniacum partly adheres to the stem, and partly falls on the ground. It is collected by the peasants towards the end of July, and the dealers who buy it from them forward it to Ispahan, or to the coast.

For commercial purposes, ammoniacum appears to be collected solely in Persia, and our supplies are obtained almost entirely by way of Bombay, whence it has been derived from the Persian Gulf. It is said, however, that some comes direct from Persia; and Vigier states that some passes through Bordeaux, whilst another portion goes from Persia through Astrachan into Russia. It reaches Bombay in bales generally of matting or coarse canvas, which contain all parts of the plant broken up and encrusted with the adherent gum-resin, and mixed with large quantities of ripe fruits. It would seem, therefore, that the collection takes place after the plant has matured its fruit, and that hardly any trouble is taken by the collectors to separate the parts of the plant from the gum-resin. The latter would appear to exude from every part, even the fruit is coated with it, and perforated by insects in the same manner as the stem. At Bombay the gum-resin is freed from extraneous substances, and sorted for the various markets.

We have already noticed in our description of Dorema Aucheri, *Boiss.*, that the ammoniacum now used in medicine, or *Persian ammoniacum*, is not the ammoniacum of Hippocrates, Dioscorides, and Pliny, which was employed in fumigations. This latter, which was derived from Africa, and distinguished therefore as *African ammoniacum*, is referred to under *Dorema Aucheri.*

General Characters and Composition.—Ammoniacum of commerce is found in two forms, namely, in separate tears, or in compact masses of agglutinated tears; the former is termed *ammoniacum in the tear*, and the latter *lump ammoniacum.*

Ammoniacum in the tear occurs in dry separate tears, which are usually more or less rounded, although sometimes of an irregular form, and varying in size from that of a coriander fruit to a cherry, or even larger. Externally their colour is of a pale yellowish-brown, which by keeping becomes cinnamon-brown; internally they are milky-white and opaque. At ordinary temperatures they are hard and brittle, and break with a smooth conchoidal fracture, but they soften by the warmth of the hand. When triturated with water they form a white emulsion. They have a peculiar characteristic odour, which become very slightly alliaceous when they are heated on the point of a penknife; their taste is bitterish, acrid, and mucilaginous.

Lump Ammoniacum occurs in nodular masses of varying sizes and forms; and consisting of tears which have been firmly agglutinated together by means of pressure or heat. It possesses similar properties to ammoniacum in the tear, but is generally less pure from being more or less mixed with foreign matters. When fractured it presents usually a varying number of milky-white broken tears, imbedded, as it were, in a darker coloured brownish substance. The half fruits (*mericarps*) of the plant are frequently found sticking to the tears in both kinds of ammoniacum.

Ammoniacum consists of *gum resin*, and *volatile oil*, but the carefully conducted experiments of the authors of *Pharmacographia*, Moss, and others, show no trace of sulphur (which had been indicated by Vigier), either in the volatile oil or crude drug. The substance called *umbelliferone*, which is a constituent of some

allied gum-resins, as, for instance, those of assafœtida and galbanum, is also absent in ammoniacum. The gum is analogous to gum arabic. The resin, which has a reddish colour, occurs in the proportion of about 70 per cent., and is described by some as tasteless, but with the odour of the gum-resin. The volatile oil, which was found in the proportion of about 1·8 per cent. by Vigier, is described by the authors of Pharmacographia as being lighter than water, and with the precise odour of the drug. Others, however, have described it as having a strong ethereal odour and bitter taste.

Medical Properties and Uses.—When given internally ammoniacum is a powerful stimulating expectorant; it is a valuable remedy in certain cases of chronic bronchitis when free from febrile disturbance, in spasmodic asthma, and in other pulmonary affections of an asthenic form. It has also been used in cases of amenorrhœa, and in certain hysterical conditions of the system arising out of that disease. Ammoniacum is, however, much less used than formerly. When applied externally, it acts as a local irritant, and is used in the form of a plaster to cause the dispersion of indolent tumours and chronic enlargements of the joints.

Per. Mat. Med., vol. ii, pt. 2, p. 185; Per. Mat. Med., by B. & R., p. 773; Pharmacographia, p. 289; U. S. Disp., by W. & B., p. 114; Garr., Mat. Med., p. 266; Hanbury, in Pharm. Journ. p. 741; Moss, in Pharm. Journ., vol. iii, ser. 3, pp. 742 and 761; Hirschsohn, in Pharm. Journ., vol. vii, ser. 3, pp. 612 & 710, translated from Pharmaceutische Zeitschrift für Russland, April 15th, 1875, p. 225.

Dorema Root.—Dymock has recently stated that the root of *Dorema Ammoniacum* is an article of commerce in Bombay. It is imported in large quantities from Persia, under the name of *boi*, and is used in the Parsee fire temples as incense. The roots are described as varying in size, the largest being three inches at the crown, and generally more or less forked. The root bark is thin and papery like that of the sumbul, but the root itself is compact and has a resinous section. Dymock also states that this is the root "which was some years ago exported to Europe

as Bombay sumbul, after having been cut up and impregnated with musk. When old and worm-eaten it becomes of a loose or spongy texture, and might be mistaken for sumbul by a superficial observer." It would thus appear that this is the source of the Indian sumbul root of Pereira, which is referred to by us under *Ferula Sumbul*. The spurious sumbul root which has recently appeared in commerce is, doubtless, derived from the same source.

Dymock, in Pharm. Journ., vol. vi, ser. 3, p. 321; Per. Mat. Med., vol. ii, pt. 2, p. 208; Pereira, in Pharm. Journ., vol. ii, ser. 1, p. 358.

DESCRIPTION OF PLATE.

Drawn from a specimen in the British Museum, collected by Aucher-Eloy at Yezdekhāst, Persia (no. 4595).

1. Portions of the stem with a branch bearing umbels of fruit.
2. A fruit.
3. Commissural, and—4. Dorsal view of a mericarp.
5. Transverse section of the same.
6. Portion of a leaf.

(3–5 enlarged.)

[A reduced figure of the whole plant is given on Plate 129.]

D'Ihlan F.L.S. ad nat. del. et lith.

Hanhart imp.

PEUCEDANUM GRAVEOLENS, *Hiern.*

N. Ord. UMBELLIFERÆ.

Tribe *Peucedaneæ*.

Genus Peucedanum,* *Linn.* B. & H., Gen. i, p. 918 (includes *Imperatoria, Pastinaca*, &c.). Species over 100, natives of most parts of the globe.

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132. Peucedanum graveolens, *Hiern, in Oliv. Fl. Trop. Africa*, iii, *p.* 19 (1877).

Dill.

Syn.—Anethum† graveolens, *Linn.* A. Sowa, *Roxb.* Pastinaca Anethum, *Spreng.*

Figures.—Woodville, t. 48; Hayne, vii, t. 17; Nees, Suppl.; Steph. & Ch., t. 137; Reich., Ic. Fl. Germ., xxi, t. 1968.

Description.—An annual or biennial herb. Stem 1—3 feet high, erect, slightly branched, cylindrical, finely striated, smooth, pale green. Leaves alternate, stalked, with the petiole flattened and dilated and with a white membranous margin, narrowly oval-triangular in outline, tripinnate or even more compound, with the ultimate segments setaceo-linear, sometimes curled, bright green, smooth. Umbels 2—4 inches wide, on long stalks, usually with about 12 rays, but sometimes with many more, no general or partial involucres. Flowers rather small, numerous, on longish slender pedicels. Calyx-teeth wanting. Petals roundish, entire, with an involute obtuse apex, yellow, shining. Filaments short, incurved. Stylopod flat, overlapping the base of the petals, somewhat lobed. Styles very short. Fruit about $\frac{1}{5}$ inch long, broadly oval in outline, rounded at both ends, smooth, tipped with the small stylopod; mericarps readily separable, much dorsally compressed, three dorsal primary ribs prominent, filiform, two lateral ones expanded into a flat, thin wing surrounding the mericarp, greyish brown, the wing yellow; vittæ solitary in each groove, broad, and two in the commissure.

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* *Peucedanum*, πευκέδανον, the classical name for a long-leaved umbelliferous plant, probably *P. officinale*, Linn.

† *Anethum*, ἄνηθον, the classical name of the plant.

used for preparing dill water; but in the British Pharmacopœia this preparation is directed to be distilled from the fruit.

Per. Mat. Med., vol. ii, pt. 2, p. 166; Pharmacographia, p. 292; U. S. Disp., by W. & B., p. 122; Pharmacopœia of India, p. 101.

DESCRIPTION OF PLATE.

Drawn from a specimen in the British Museum, collected in Abyssinia by Schimper.

1. Portion of a plant in flower and fruit.
2. A flower.
3. A petal.
4. Pistil.
5, 6. Fruit seen edgeways.
7. Dorsal, and—8. Commissural view of a mericarp.
9. Section of the same.

(2–4, 6–9 enlarged.)

CORIANDRUM SATIVUM, *Linn.*

N. Ord. UMBELLIFERÆ.

Tribe *Caucalineæ*.

Genus Coriandrum,* *Linn.* B. & H., Gen., i, p. 926. Species 2, natives of the Mediterranean region.

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133. Coriandrum sativum, *Linn., Sp. Plant., ed.* 1, *p.* 256 (1753).

Coriander. Coliander.

Figures.—Woodville, t. 137; Hayne, vii, t. 13; Nees, t. 286; Steph. and Ch., t. 94; Berg & Sch., t. 13 e; Syme, E. Bot., iv, t. 632; Sibth., Fl. Græca, t. 283; Baill., Hist. Pl., vii, figs. 134—8.

Description.—An annual herb, with an erect, slender, smooth, somewhat flexuose, solid stem 1—2 feet high, corymbosely branched in the upper part. Lower leaves on long petioles, pinnate, with nearly sessile roundish-oval deeply lobed leaflets, crenate-serrate on the margin; upper leaves nearly sessile, bluntly deltoid in outline, bi- or even tripinnate, with the ultimate segments strap-shaped or linear and obtuse; all smooth, light-green. Umbels rather small, about $1\frac{1}{4}$ inch across, stalked, terminal, lax, of few (about 5—8) rays, general involucre none or a single small bract, partial of 3 to 5 bractlets; flowers on rather long pedicels, the outer ones radiant. Calyx-teeth unequally developed, triangular, spreading, acute, two much larger than the other three, curved. Petals with a long incurved blunt point, white or pink, the outer one of the radiant flowers much enlarged and deeply bifid. Stamens spreading, anthers pink. Styles divaricate. Fruit nearly globular, $\frac{1}{6}$—$\frac{1}{8}$ inch long, crowned by the calyx-teeth and capped by the sharply conical stylopod bearing the slender spreading styles, smooth, pale brown; mericarps coherent by the pericarp and not readily separable, very concave on the commissural surface, and thus enclosing a large lenticular cavity, up the centre of which passes the free carpophore, primary ridges faintly marked, very sinuous, secondary ones stronger but very slightly raised, straight,

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* *Coriandrum*, in Greek κορίανον and κορίαννον, the classical name; from κόρις, a bug, referring to the smell.

sharp, vittæ absent from the dorsal part of the mericarp, but two curved ones on the commissural surface.

Habitat.—This is scarcely known in a wild state, but is thought with much probability to be native to Greece and the Caucasian region. In several parts of the Mediterranean district it is found growing in vineyards and among crops in a doubtfully wild state, but in other parts of Europe, including England, it can only be considered as a casual straggler from cultivation. In this country it occurs under such circumstances near London. As a cultivated plant it has spread over most of the warm countries of the globe, Egypt, Nubia, Abyssinia (where it is much used), North India, China, Japan, and both North and South America. It is grown in small quantity in several parts of Europe, and rarely in England in the south-east part of Essex, where it is called "col," and sown along with caraway. It flowers in June and the seed is ripe in August or September.

Syme, E. Bot., iv, p. 178; Hook. f., Stud. Fl., p. 163; Willk. and Lange, Prod. Fl. Hisp., iii, p. 32; Boissier, Fl. Orient., ii, p. 920; Lindl., Fl. Med., p. 293; Flück. & Hanb., Pharmacogr., p. 293.

Official Parts and Names.—1. Coriandri Fructus; the dried ripe fruit: 2. Oleum Coriandri; the oil distilled in Britain from coriander fruit (B. P.). The ripe fruit dried (I. P.). Coriandrum; the fruit (U. S. P.).

1. Coriandri Fructus, or Coriandrum.—*Production and Commerce.*—Coriander fruit of the British Pharmacopœia is directed to be obtained from plants cultivated in Britain. In England the plant is grown as already noticed, to a small extent in the eastern counties, but more especially in Essex. When the fruit is mature the plant is cut with sickles, and when dry the fruit is threshed out; the best land, according to R. Baker, yields, on an average, about 15 cwt. per acre. It is imported into the United States of America from Europe.

General Characters and Composition.—Coriander fruit of commerce, which is commonly known as *coriander seed*, is nearly globular, ordinarily about $\frac{1}{5}$ of an inch in diameter, or about the

average size of white pepper, slightly beaked, finely ribbed, hard, of a brownish-yellow colour, an agreeable and mild aromatic taste, and when bruised having a fragrant odour. It consists, as particularly noticed in our botanical description, of two hemispherical mericarps closely united. In an unripe state the fruit, like that of the plant generally when fresh, has an offensive odour, which has been compared to that of bugs. The above description of coriander fruit applies more particularly to that collected in Europe, that which comes from Bombay being larger and somewhat elongated in form.

Coriander fruits yield about half per cent. of *volatile oil*, to which their properties are essentially due; it is described below. According to Trommsdorff, they also contain about 13 per cent. of fixed oil.

Medical Properties and Uses.—Coriander fruits possess stimulant and carminative properties like those of the other aromatic umbelliferous fruits; and may therefore be given in similar cases to those of Caraway. They are, however, but little employed in medicine. Coriander fruit is used as a constituent of several official preparations; and is thought by some to correct the odour and taste of senna better than any other aromatic. Coriander fruit is also employed in veterinary practice. The chief consumption of coriander is, however, as a flavouring agent by the cook and gin distiller.

2. Oleum Coriandri.—*Characters and Composition.*—Oil of coriander may be readily obtained from the bruised fruits by distillation with water. It is pale yellow or colourless, with the agreeable odour of the fruit, a mild aromatic taste, a specific gravity varying from 0·859 to 0·871, and a boiling point of 302°. It is said to be isomeric in composition with *borneol* obtained from *Dryobalanops aromatica*, the Borneo camphor tree; and it is also stated by Kawalier that by the abstraction of a molecule of water it is converted into an oil of offensive odour. To this oil the strong disagreeable smell of the unripe fruit and fresh plant already referred to, is probably due.

Medical Properties and Uses.—Oil of coriander has the medical

properties of the fruit; and, like it, may be used to correct the griping qualities and disagreeable taste of other medicines. In the British Pharmacopœia it is a constituent of syrup of senna.

Per. Mat. Med., vol. ii, pt. 2, p. 169; Pharmacographia, p. 293; U. S. Disp., by W. & B., p. 337; R. Baker, in Morton's Cyclopædia of Agriculture, vol. i, p. 545; Kawalier, in Pharm. Journ., ser. 1, vol. xii, p. 396.

DESCRIPTION OF PLATE.

Drawn from a specimen grown in the garden of the Royal Botanic Society, Regent's Park.

1. Upper part of a plant.
2. A radiant flower.
3. Three petals of the same.
4. Pistil.
5, 6. Fruit.
7. Outer, and—8. Commissural surface of a mericarp.
9. Transverse section of fruit.
10. Lower leaves.

(2–4, 6–9 enlarged.)

CUMINUM CYMINUM. *Linn*

Hanhart imp

N. Ord. UMBELLIFERÆ.

Tribe *Caucalineæ*.

Genus **Cuminum**,* *Linn.* B. & H., Gen., i, p. 926. There is but a single species.

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134. Cuminum Cyminum, *Linn., Sp. Plant., ed.* 1, *p.* 254 (1753).

Cumin or *Cummin.*

Syn.—C. hispanicum, *Mérat.*

Figures.—Woodville, t. 56; Hayne, vii, t. 11; Nees, t. 288; Baill., Hist. Pl., vii, fig. 70, 71 (fruit).

Description.—An annual herb. Stem about a foot high, much branched, cylindrical, solid, smooth, strongly striate or angular, branches spreading. Leaves nearly sessile, the lower ones with longer stalks, petioles dilated and stem-clasping, blade ternately divided once or twice into long, slender, setaceo-linear, entire, acute segments, smooth, pale green. Umbels stalked, rather irregular, with few (4—7) rays; general involucres of a few, long, spreading or deflexed, linear-setaceous, rigid, trifid or entire bracts, partial ones of two to four similar but smaller bracts on the outer side of the umbels, at first erect and exceeding the flowers, afterwards deflexed; flowers few, crowded, on short pedicels. Calyx-teeth setaceous, persistent, unequal, the two outer usually much the longest. Petals nearly equal, deeply divided into two lobes, rose-coloured or white. Styles short, erect. Fruit about $\frac{1}{4}$ inch long, oval-oblong, slightly narrowed at both ends, very little laterally compressed, crowned by the persistent calyx-teeth, greyish-brown; mericarps not readily separating at the concave commissure, primary ridges slightly developed, secondary ones more prominent, both or the latter only finely hispid with papillose hairs; vittæ small, solitary beneath the secondary ridges, and two in the commissure.

Habitat.—This small umbellifer is probably a native of some part of Western Asia, but can scarcely be said to be known in a

* *Cuminum*, *κύμινον*, the classical name of the plant.

wild state. It has been cultivated from the earliest times in the countries bordering the Mediterranean; and is found in a subspontaneous condition in several parts of North Africa, especially in Upper Egypt, and in Arabia. It also occurs in Spain, where it is known to have been introduced from Egypt, and is cultivated in China and in the United States. Malta and Sicily afford the chief supply. Though easily grown in this country, we do not remember to have met with this in the London botanic gardens; but it was formerly more common here, and was cultivated in Gerard's time and earlier.

The hairy covering of the fruit varies in amount, and there is a cultivated variety in which it is wholly absent; usually the secondary ridges have rather long spinous hairs, whilst those on the alternating primary ridges are much shorter.

DC. Prod., iv, p. 201; Boissier, Fl. Orient., ii, p. 1080; Willkomm and Lange, Prod. Fl. Hisp., iii, p. 31; Lindl., Fl. Med., p. 51; Flück. & Hanb., Pharmacogr., p. 295.

Part Used and Name.—Cumini Fructus; the dried ripe fruit. Cumin is not official in the British Pharmacopœia, the Pharmacopœia of India, or the Pharmacopœia of the United States. But it was formerly recognised in the London and Edinburgh Pharmacopœias.

Cumin or Cummin was well known to the ancients, and is alluded to in the Old Testament, in the 28th chapter of Isaiah; and, in the New Testament, in the 23rd chapter of St. Matthew.

General Characters and Commerce.—The botanical characters of these fruits, which are commonly termed *Cumin seeds*, have been already given. They have a brownish or greyish-yellow colour; a strong aromatic odour; and a corresponding aromatic taste. Both the odour and taste of cumin are analogous to, but hotter and far less agreeable than, caraway.

Cumin fruits are exported from Morocco, Sicily, Malta, Bombay, and Calcutta.

Composition.—The properties of cumin fruits both as a condiment and medicine are due to a *volatile oil*, of which they yield nearly 3 per cent. This oil, as shown by Trapp, is also contained

in the proportion of about 1½ per cent. in the fruits of *Cicuta virosa*, L., as we have noticed in our description of that plant. Oil of cumin is usually a limpid oil, of a pale yellow colour, a disagreeable odour, and strong acrid taste; it is dextrogyre, and has a specific gravity of about 0·945. It is essentially composed of the hydrocarbon *cymol* or *cymene*, and an oxygenated oil named *cuminol* or *cuminaldehyd*. *Cymol* is a dextrogyre fluid, with a specific gravity of 0·867, a boiling point of about 350°, and an odour resembling that of lemons. *Cuminol* is also dextrogyre, with a specific gravity of 0·972, a boiling point of about 456°, and having the odour and taste of cumin.

Medical Properties and Uses.—Cumin agrees with the other umbelliferous fruits in being mildly stimulant, aromatic, and carminative. It is, however, rarely or ever used internally in this country, or in the United States, for medicinal purposes, caraway being equally efficient and a much more agreeable remedy. In India, however, cumin fruits are much valued as a carminative by the natives. As a discutient and resolvent, cumin is sometimes used externally in the form of the old official "Emplastrum Cumini" of the London Pharmacopœia. In this country it is now chiefly employed in veterinary medicine.

As a condiment, cumin is largely used in India; and to some extent also, in this country and elsewhere, as a constituent of curry powder.

Isaiah xxviii, 25–27; Matthew xxiii, 23.

Per. Mat. Med., vol. ii, pt. 2, p. 167; Pharmacographia, p. 295; U. S. Disp., by W. & B., p. 1585; Trapp, Ann. der Chem. u. Pharm. (1858), p. 386; Watts' Dict. Chem., vol. ii, p. 177.

DESCRIPTION OF PLATE.

Drawn from a specimen in the British Museum, collected by Sir J. G. Wilkinson in Egypt. 1. Whole plant in fruit. 2. An umbel of flowers. 3. A flower. 4. The same with the petals and stamens removed. 5. A petal. 6, 7. Fruit. 8. Dorsal, and—9. Commissural view of a mericarp. 10. Section of the same. (3–5, 7–10 enlarged.)

DAUCUS CAROTA. Linn.

N. Ord. UMBELLIFERÆ.

Tribe *Caucalineæ*.

Genus Daucus,* *Linn.* B. & H., Gen., i, p. 928 (includes *Orlaya* and *Durieua*). Species about 50, natives of the temperate and warm regions of both hemispheres.

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135. Daucus Carota,† *Linn., Sp. Plant, ed.* 1, *p.* 242 (1753).

Carrot.

Syn.—D. maritimus, *Withering.*

Figures.—Woodville, t. 50: Hayne, vii, t. 2; Steph. and Ch., t. 56; Nees, t. 287 (cultivated form); Syme, E. Bot., iv, t. 615 (bad); Reichenb., Ic. Fl. Germ., xxi, t. 2000.

Description.—Biennial or annual. Root in the wild plant slender, elongated, tough, woody, tapering, white or pale yellow, in the cultivated form much enlarged 1—2 inches in diameter at the summit, elongated, conical, pointed below, rounded at the top, transversely rugose, with faint furrows from some of which are given off tufts of root-fibres, texture firm but rather brittle, bright pinkish-orange, with the central portion yellow. Stem 6 inches to 2 feet or more high, erect, slender, stiff, solid, furrowed, more or less bristly with stiff spreading hairs, grey, slightly branched. Root-leaves 6—12 inches long, on long stout channelled petioles dilated below, narrowly triangular in outline, tripinnate, leaflets deeply bi- or tripinnatifid with small oblong acute segments. Stem leaves few, alternate, much smaller, with dilated petioles, bipinnate, triangular-oblong in outline, the uppermost usually with the segment linear and distant, all glabrous or hairy, dull greyish-green. Umbels few, long-stalked, flat-topped in flower, about 3 inches wide, rays very numerous, hispid, very unequal; general involucre large, of numerous horizontally spreading pinnatisect bracts, with membranous margins at the base and linear attenuated segments, as long as the rays of the

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* *Daucus*, δαῦκον of Theophrastus; the name of some umbelliferous plant.

† *Carota*, a mediæval name, said to be from the celtic *car*, meaning red.

umbel, partial involucres linear-lanceolate, acute, with membranous borders. Flowers on long stalks, small, closely placed, numerous, the central one of the umbel usually large with thick crimson or purple petals, abortive. Calyx-teeth almost absent. Petals notched, with a long inflexed point, dull white or yellowish, the outer ones larger and radiant. Stylopod thick, fleshy, styles erect. Fruit about $\frac{1}{8}$ inch long, ovoid, capped with the persistent styles and stylopod, greenish brown, somewhat dorsally compressed, commissure flat, primary ridges faintly marked, three on the back of the mericarp with a few short bristles, two (scarcely noticeable) on the commissural face, secondary ridges strongly winged, the wing cut down to the base into sharp, soft spines as long as the diameter of the fruit; vittæ solitary beneath the secondary ridges and two smaller ones on the commissure; carpophore free, entire.

Habitat.—A common plant throughout Europe, except the very extreme north, and extending also into Abyssinia, northern Africa, Madeira and the Azores, and eastwards through northern Asia to Siberia and Kamptschatka and to northern India. In Great Britain it is one of the most frequent species in dry places, fields, roadsides, banks and downs, flowering from July to September. It has become introduced into North America and other countries.

The cultivation of the carrot was carried on by the Greeks, though to no great extent. The development of the large succulent red root has been shown to be brought about by culture in so few as three generations; conversely the plant if left to itself soon returns to its natural condition. Besides the change in the root, the whole plant under cultivation becomes much more luxuriant, loses its bristly hairs and acquires a deep green colour; the root-leaves especially are usually quite glabrous and of an intense green; this changes when beginning to go off into a bright orange-yellow. There are many varieties of the root in cultivation, both in form and colour, some are white, others purplish.

The central barren flower is solitary and represents a partial umbel; it is sometimes very large and fleshy and varies in colour

from crimson to almost black; it is often surrounded by a partial involucre as the other umbellules. Rarely all the flowers are purple.

During the ripening of the fruit the rays of the umbel converge and fold inwards, and, the outer ones being very much longer than the inner, a very concave cup results resembling a bird's nest, by which name it is commonly known.

The spines of the fruit are often described as hooked; we have not observed any specimens with this character, but there are usually at the apex two or three minute spreading points pointing downwards.

A form of the wild plant common on maritime cliffs of the west of Europe (including England) has been considered a distinct species. It has a more robust and spreading habit, and the umbels remain flat in fruit, but these characters are found very inconstant.

Syme, E. Bot., iv, p. 156; Hook. f. Stud. Fl., p. 170; Watson, Comp. Cyp. Brit., p. 196; Boissier, Fl. Or., ii, p. 1076; Lowe, Man. Fl. Madeira, i, p. 367; Lindl., Fl. Med., p. 54; Vilmorin, in Trans. Hort. Soc., ser. 2, ii (1842), p. 348.

Official Part and Name.—Carota; the fruit (U. S. P. *Secondary*). It is not official in the British Pharmacopœia, or the Pharmacopœia of India; but the fruits of the wild carrot (*fructus* seu *semina dauci sylvestris*) were formerly recognised in the London and Dublin Pharmacopœias; and the root of the cultivated carrot (*radix dauci sativi*) was also official in the London, Edinburgh, and Dublin Pharmacopœias.

1. Carota.—By this name the *fruits*, commonly called *seeds*, are now official in the Pharmacopœia of the United States; but this was formerly the official name of the root in the London Pharmacopœia.

General Characters and Composition.—Carrot fruits are brownish in colour, ovoid in form, from one to one and a half lines long, and with a peculiar aromatic odour, and a warm bitterish taste.

No complete analysis of these fruits has been published, but

their properties are essentially due to a *volatile oil*, which may be separated by distillation with water.

2. Dauci Radix.—*General Characters and Composition.*—The root of the wild carrot is conical in form, branched, of a whitish-yellow colour, with a strong aromatic odour, and an acrid, disagreeable, bitterish taste; that of the cultivated plant is also conical, thick and fleshy, usually orange-red in colour, of a peculiar, agreeable, aromatic odour, and a sweet, peculiar, mucilaginous, agreeable taste.

The principal constituents of carrot root are *carotin, hydrocarotin, oil, sugar, pectin, nitrogen compounds,* and a little *volatile oil. Carotin,* the colouring matter of carrot root, is a crystalline, ruby-red, tasteless, neutral substance, with a faint violet odour, especially when heated. Carotin is said to be probably formed by oxidation from hydrocarotin, which is a colourless substance. The *volatile oil* may be obtained, although in but very small amount, by distillation of the fresh roots with water. It is described as colourless, and with a strong pungent odour and taste.

Medical Properties and Uses.—Carrot fruits possess aromatic, stimulant, and carminative properties; and are also said to be diuretic. They have been employed in some diseases of the kidneys, flatulent colic, dropsies, &c.; but in this country their use is now obsolete.

The *wild root* is sometimes used in the United States instead of the fruits, which it is said to resemble in properties. The root of the cultivated plant when boiled and beaten into a pulp with water, is sometimes applied as a poultice to fœtid ill-conditioned sores to correct the discharge; and to allay the pain of phagadenic and carcinomatous ulcers. The raw scraped root made into an ointment with lard, is also said to be a useful stimulating application to excoriated or ulcerated surfaces.

The root of the cultivated carrot is extensively employed for culinary purposes, and for feeding cattle.

Steph. & Ch., Med. Bot., by Burnett, vol. i, pl. 56; Per. Mat. Med., vol. ii, pt. 2, p. 172; Christ. Disp., p. 397; Thomson,

Lond. Disp., by Garrod, p. 333; Watts, Dict. Chem., vol. i, p. 805 and 807, and vol. ii, p. 307; U. S. Disp., by W. & B. p. 228; Amer. Journ. of Pharmacy, Nov., 1866, p. 505.

DESCRIPTION OF PLATE.

Drawn from a specimen collected at Greenhithe, Kent. The root added from a cultivated plant.

1. Upper part of plant in flower and fruit.
2. A flower.
3. A petal.
4. Pistil.
5. Fruit.
6. Dorsal; and 7, front view of a mericarp.
8. Section of fruit.
9. The cultivated root.

(2–4, 6–8 enlarged.)

M&N Hanhart imp.

N. Ord. CORNACEÆ. Lindl., Veg. K., p. 782; Le Maout & Dec., p. 475.

Genus Cornus,* *Linn.* B. & H., Gen., i, p. 950. About 30 species are known, nearly all natives of the temperate regions of the northern hemisphere.

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136. Cornus florida, *Linn., Sp. Plant., ed.* 1, *p.* 117 (1753).

Flowering Dogwood. Boxwood.

Figures.—Barton, i, t. 3; Bigelow, t. 28; Michaux, Arbres Am. Sept., iii, t. 3; Bot. Mag., t. 526.

Description.—A tree not reaching more than 30 feet in height, much branched, bark dark, thick, rough on the larger, smooth and with well-marked leaf-scars on the smaller branches. Leaves opposite, without stipules, stalked, 3—4 inches long, oval or ovate-oval, acute at both ends but especially at the apex, entire, slightly rough, dark green above, much paler beneath and finely pubescent when young, strongly veined, the lateral veins curved running on to the apex. Flowers small, sessile, 12—20 together, closely crowded on the expanded end of stout terminal peduncles an inch or more in length, the whole surrounded by an involucre composed of 4 large, white, faintly nerved, obovate bracts, 1½ inch long, narrow at the base, thickened and deeply notched at the end, with the point usually either reflexed or inflexed. Calyx with a long tube united with the ovary and 4 short blunt spreading teeth, smooth. Petals 4, alternate with the calyx-teeth and many times longer, linear-oblong, blunt, spreading, greenish-yellow, valvate in the bud. Stamens 4, shorter than the petals and alternate with them, inserted on the margin of the top of the ovary (epigynous), erect, anthers short, dorsifixed, 2-celled. Ovary inferior, adherent to the calyx-tube, 2-celled, with a single ovule in each cell pendulous from the summit, style surrounded by a prominent epigynous disk, simple, shorter than the stamens, stigma terminal, flat. Fruit berry-like, ovoid, crowned with the

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* The classical name for *C. mas*, L.

remains of the flower, about ½ inch long, scarlet, shining, 3 or 4 together, pulp scanty, stone (endocarp) hard, bony, 2-celled, with a single seed in each cell. Seeds oblong, compressed, embryo with leafy cotyledons and a straight superior radicle in the axis of fleshy endosperm.

Habitat.—A native of rocky and damp woods and forests in the United States of America, barely reaching into Canada, but extending from Massachusetts to Florida and becoming more common southwards. The name *florida* alludes to the showy appearance of the shrub when in flower, yet in truth the flowers themselves are quite inconspicuous, the beauty of the inflorescence being due to the very large and regularly disposed involucral bracts which have all the appearance of a handsome corolla of 4 petals and are very persistent. At the time of flowering in May the leaves are quite small and unexpanded. The brillant scarlet fruit is ripe in September. A variety is rarely found with the involucral leaves pink.

This very ornamental little tree was introduced into our gardens before 1740, but is not often seen. It is grown in Kew gardens.

DC. Prod., iv, p. 273; A. Gray, Man. Bot. U. St., p. 200; Chapman, Fl. South. St., p. 168; Hook., Fl. Bor.-Am., i, p. 277; Lindl., Fl. Med., p. 81.

Official Part and Name.—Cornus Florida; the bark (U. S. P.). It is not official in the British Pharmacopœia, or the Pharmacopœia of India.

General Characters and Composition.—The bark from every part of the tree is official in the Pharmacopœia of the United States, but that from the root is said to be the most active; it is commonly known as Dogwood bark. The dried bark is in more or less quilled pieces, which are commonly several inches long, from half an inch to two inches broad, and two or three lines thick. The quills are either covered by a greyish-red outer bark, or are wholly or entirely deprived of this layer, as is very frequently the case when the bark has been obtained from the roots; they are very brittle, breaking with a short fracture, and exposing surfaces

of a mottled red and white colour. The odour is very feeble; the taste bitter, astringent, and slightly aromatic, and when fresh slightly acrid. The powder is of a grey colour tinged with red.

No accurate analysis has been made of this bark, but the experiments of Dr. Walker and Mr. James Cockburn, of the United States, indicate the presence of *bitter extractive, tannic* and *gallic acids,* a *crystalline substance, gum resin,* and other unimportant ingredients. A bitter principle, to which the name of *cornine* has been given, was also discovered by Mr. Carpenter; and a more recent investigation by Professor Maisch also indicates the presence of some peculiar bitter principle; but at present this has not been isolated. The so-called cornin which is used by the eclectic practitioners in the United States is a mixed substance. The properties of the bark would appear, therefore, to depend essentially on a peculiar bitter principle, and probably, to some slight extent also, upon tannic acid. Either water or alcohol extracts the virtues of the bark.

Medical Properties and Uses.—Dogwood bark is tonic, astringent, and slightly stimulant; but in the recent state it is apt to disagree with the stomach and produce pain. It has been used as a substitute for cinchona bark in the treatment of intermittent and remittent fevers; and of its value in the treatment of intermittent fevers there can be no doubt, as its efficacy has been so frequently testified to. As a simple tonic its value appears to be also quite established. It is, however, but little used at the present day by regular practitioners, cinchona or sulphate of quinia having replaced it; but the cornin of the eclectic physicians is extensively employed by them.

The flowers have similar properties to the bark, and are occasionally used for the same purposes. The ripe fruit infused in brandy is also employed in domestic practice, as a stomachic. The young branches divested of their bark are also in use for whitening the teeth; and from the bark of the roots the Indians extract a good scarlet dye.

Other Official Species of Cornus.—Besides the bark of *Cornus florida,* that of two other species of *Cornus,* namely, *Cornus*

circinata or *Round-leaved Dogwood,* and *Cornus sericea* or *Swamp Dogwood,* are also official in the Secondary list of the United States Pharmacopœia.

Both these barks occur commonly in quills, and both have a bitter, astringent, and somewhat aromatic taste, like the common dogwood bark ; but that of the swamp dogwood is regarded as less bitter, and more astringent.

Both barks have probably the same chemical composition as that of the bark of *Cornus florida ;* they are employed medicinally in the same cases and in like doses, and appear to be equally efficient.

Per. Mat. Med., vol. ii, pt. 2, p. 706 ; U. S. Disp., by W. & B., p. 338; Lindley's Flora Medica, p. 81 ; Stille's Ther. and Mat. Med., vol. i, p. 463 ; Grover Coe's Concentrated Organic Medicines, 3rd ed., p. 272, New York ; Amer. Journ. Pharm., vol. vii, p. 109 ; Trans. Amer. Med. Assoc., 1849, vol. ii, p. 670 ; Maisch, in Proc. Amer. Pharm. Assoc., 1859, p. 315.

DESCRIPTION OF PLATE.

Drawn from specimens in the British Museum collected by Doubleday in Ohio.

1. A flowering shoot.
2. A flower.
3. Section of the same.
4. A petal.
5. Section of ovary.
6. A twig with adult leaves and fruit.

(2–5 enlarged.)

SAMBUCUS NIGRA *Linn*

N. Ord. CAPRIFOLIACÆ. Lindl., Veg. Kingd., p. 766; Le Maout & Dec., p. 479.

Genus Sambucus,* *Linn.* B. & H., Gen., ii, p. 3. Species about 12, interspersed in temperate regions throughout the globe.

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137. Sambucus nigra, *Linn., Sp. Plant., ed.* 1, *p.* 269 (1753).

Elder. Bore Tree.

Fig.—S. maderensis, *Lowe.*

Figures.—Woodville, t. 211; Hayne, iv, t. 16; Steph. & Ch., t. 79; Nees, t. 266; Berg & Sch., t. 15 d; Syme, E. Bot., iv, t. 637; Reichenb., Ic. Fl. Germ., xii, t. 730; Nees, Gen. Fl. Germ.

Description.—A shrub or small tree reaching a height of 20 feet, with a trunk 1½ feet or more in circumference, much branched, branches opposite; bark thick, rather corky, rough, grey; young branches smooth, somewhat angular, beset with lenticels. Leaves opposite, usually without stipules, imparipinnate, stalked, 6—8 inches long; leaflets in 2—4 opposite pairs and a terminal one, shortly stalked, 1½—3 inches long, oval or oblong-lanceolate, rounded at the base, acute or acuminate at the apex, strongly and sharply serrate, glabrous and shining, paler beneath. Flowers small, numerous, one terminating each of the smaller ramifications of the inflorescence, which dichotomise immediately beneath, so that the flowers (except the ultimate ones) appear sessile, closely arranged in large, stalked, terminal, flat-topped corymbose cymes 4—7 inches across, the 3—5 long primary branches of which first divide into 3 or 5 and then are frequently and irregularly dichotomous; all quite glabrous, bracts none. Calyx-tube adherent to the ovary, smooth, the limb cut nearly to the base into 5 triangular, acute, glabrous, spreading segments. Corolla nearly flat, about ⅓ inch wide, without a tube, creamy-white, very deeply divided nearly to the base into 5 broadly oval, blunt, equal segments, convex above, readily deciduous. Stamens 5, inserted on the corolla between the bases of the

* *Sambucus*, the classical name.

segments, spreading, filaments about as long as the corolla-lobes, anthers dorsifixed, 2-celled, heart-shaped, yellow, extrorsely dehiscent. Ovary half-inferior, 3-celled, with a single pendulous ovule in each cell, free portion rounded, projecting in the centre of the flower and crowned with 3 large, distinct, sessile stigmas; no style. Fruit small, ovoid, soft, about $\frac{1}{4}$ inch long, crowned by the persistent calyx-teeth, smooth, at first red, but when ripe deep purplish black, skin thin, pulp scanty, containing 3 pyrenes which are loose in the pulp, oblong, compressed, often with the long funicle still attached to their tops, chartaceous, pale brown, covered with closely placed warty callosities. Seeds one in each pyrene, testa membranous, embryo straight, with a superior radicle, in the axis of the firm oily endosperm.

Habitat.—This familiar little tree is a native of all parts of Europe, except the north-eastern districts, and extends into Northern Africa, the Caucasian provinces, and Southern Siberia. In England it is very common in hedges and woods, but especially frequent as a planted tree near houses and in cottage gardens. In Scotland, as in Sweden and other northern countries, it is not considered to be native.

A variety with deeply cut leaves, *laciniata*, is met with in gardens, also a form with the fruit pale greenish yellow instead of purple. Small stipules are occasionally present.

The Elder flowers in June, the copious masses scenting the air with their peculiar odour, and the berries are ripe in September and October; the purple colour resides in the skin of the fruit, the pulp being transparent; the stalks share in the colorisation, becoming a fine blood-red when the fruit is ripe.

The name Bore or Bour-tree, by which the Elder is known in North Britain, refers to the readiness with which the young branches can be rendered hollow by cleaning out the large cylinder of pith which they contain.

S. maderensis, Lowe, found in Madeira, differs from *S. nigra* in its rather longer and narrower leaflets, scentless flowers, and (usually) yellowish-green fruit with a milder flavour, but cannot be considered as specifically distinct.

Syme, E. Bot., iv, p. 199; Hook. f., Stud. Flora, p. 174; Watson, Comp. Cyb. Brit., p. 199; Gren. & Godr., Fl. France, ii, p. 7; Ledebour, Fl. Ross., ii, p. 383; Lowe, Fl. Madeira, i, p. 381; Lindl., Fl. Med., p. 446.

Official Part and Name.—Sambuci Flores; the fresh flowers (B. P.). The flowers (I. P.). These flowers are not official in the Pharmacopœia of the United States, those of *Sambucus canadensis* being there recognised instead. Formerly, besides the flowers, the fruit, inner bark, and fresh leaves were official in the pharmacopœias of this country.

Collection and Preservation.—In the British Pharmacopœia Fresh Elder Flowers, separated from the stalks, or an equivalent quantity of the flowers preserved while fresh with common salt, are directed to be used in making Elder Flower Water, which is the only official preparation. The preserved flowers are commonly known as *pickled flowers;* these are prepared with alternate layers of the flowers and common salt compressed and preserved in a well-closed vessel (usually a cask), the water which exudes being rejected. The best Elder Flower Water is, however, obtained from the flowers gathered in dry sunny weather, and distilled as soon as possible afterwards. The flowers are also kept in a dried state; these are best prepared as follows :—The cymes after being gathered are thrown together into a large heap and left for a few hours, by which they become somewhat heated, the corollas, the part especially required, then fall off from the flowers, and are afterwards separated from the stalks by shaking, rubbing, and sifting; and are finally dried quickly.

General Characters and Composition.—The fresh flowers (corollas) are small, white, with an agreeable, although somewhat heavy and sickly odour, and a bitterish taste. When dried they are much shrivelled, and have a dull brownish-yellow colour, but they still retain an agreeable, although somewhat different odour from the fresh flowers, and have a bitterish, somewhat gummy taste.

These flowers, like those of *Sambucus canadensis*, when distilled with water, yield a very small quantity of an essential oil, to which they owe their properties. This oil is colourless, of a butter-like

consistence, and with the strong odour of the fresh flowers. It has a specific gravity lower than that of water, and is easily decomposed when exposed to the air. At 0° it solidifies to a crystalline mass ; and has a very high boiling point. It requires further examination.

Medical Properties and Uses.—The properties and uses of Elder Flowers are similar to those of *Sambucus canadensis*, under which plant they are described.

Properties and Uses of Other Parts of the Elder Plant.—Besides the flowers, the leaves and young buds, the inner bark, the fruit, and other parts of the plant, have been, or are now, used on account of their medical or other useful properties.

1. *The Fruit.*—The fruits of the Elder, which are generally called Elderberries, are reputed to be cooling, aperient, and diuretic. They are extensively used at the present day in the manufacture of the domestic wine which is commonly known as Elder or Elderberry wine. It is also said that they are largely employed for adulterating Port wine. Elderberries yield by expression a purple-coloured juice, usually termed *elder rob*, which was formerly official when inspissated, and under the old name of *Rob Sambuci* was in frequent use as a mild laxative and diuretic.

2. *The Fresh Leaves and Buds.*—These were formerly in use on account of their purgative properties. The fresh leaves have a very disagreeable odour. They were official in the Dublin Pharmacopœia, and used in the preparation of a cooling ointment. They are still employed for similar purposes, and on account of the fine green colour they communicate to oils and fats, as in the *Oleum viride* and *Unguentum Sambuci foliorum* or *Unguentum Sambuci viride* of the shops. Christison says he has known the leaves cause severe irritant poisoning in a child. Fresh Elder leaves are also commonly supposed to be offensive to most insects, hence a decoction of them is sometimes used by gardeners to keep off caterpillars from delicate plants. The leaves laid in the subterranean passages of moles are likewise said to drive them away.

3. *The Inner Bark.*—The inner bark had formerly a great

reputation as a hydragogue cathartic in dropsies, and was official in the Dublin Pharmacopœia. Its use has now become obsolete, although the medical testimony in its favour has been very strong. It seems well worthy of further trials. More recently it has been stated to be a valuable remedy in epilepsy. A good form of administration is the decoction; this may be prepared by boiling two ounces of the bark in two pints of water to one pint, and given in doses of from two to four ounces. The principal constituents of the inner bark appear to be a *soft resin* and *valerianic acid*. More recently the expressed juice of the root has been recommended as a remedy of still greater power in dropsical affections.

Evelyn says, speaking of the common elder :—" If the medicinal properties of the leaves, bark, berries, &c., were thoroughly known, I cannot tell what our countrymen could ail for which he might not fetch a remedy from every hedge, either for sickness or wound."

The wood of the common Elder is made into skewers for butchers, tops for angling rods, and needles for weaving nets, &c. The light pith is cut into balls and used in electrical experiments.

Per. Mat. Med., vol. ii, pt. 2, p. 156; Miller's Gardener's Dictionary, vol. ii, pt. 2; Pharmacographia, p. 297; U. S. Disp., by W. & B., p. 768; Lindley & Moore's Treasury of Botany, p. 1013; Gmelin's Chemistry, vol. xiv, p. 368; Steph. & Church., Med. Bot., by Burnett, vol. ii, pl. 79; Watts' Dict. Chem., vol. v, p. 186; Garr., Mat. Med., p. 271; Waring's Man. Pract. Therap., p. 637.

DESCRIPTION OF PLATE.

Drawn from a specimen collected by the Thames side in Surrey. 1. A young flowering shoot. 2. A flower. 3. Vertical section of pistil. 4. Upper, and—5. Under surface of corolla. 6. Calyx and pistil. 7. Transverse section of ovary. 8. Portion of cluster of " berries." 9. A fruit. 10. Transverse section of the same. 11. A pyrene. 12. Vertical, and—13. Transverse section of the same. (2–7, 9–13 enlarged.)

D Blair F.L.S ad nat. del. et lith

SAMBUCUS CANADENSIS *Linn.*

M & N Hanhart imp.

N. Ord. Caprifoliaceæ.
Genus Sambucus.

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138. Sambucus canadensis, *Linn., Sp. Plant., ed.* 1, *p.* 269 (1753).

Common American Elder.

Not previously figured.

Description.—A semi-shrubby perennial. Stems scarcely woody, 5—10 feet high, with very large white pith, slightly branched. Leaves opposite, stalked, without stipules, 6—12 inches long, imparipinnate, leaflets stalked, opposite, in 3—5 pairs and an odd one, often with minute stipellæ at the base, 2—4 inches long, ovate, much acuminate, the lower pair or pairs often again divided into 3, strongly serrate, glabrous above, paler and often slightly hairy beneath. Flowers rather larger than in *S. nigra,* pure white, quite similarly arranged in flat-topped corymbose cymes which are rather larger and more lax than in that species, bracts small, at the base of the ramifications. Fruit as in *S. nigra.*

Habitat.—This species takes precisely the place of *S. nigra* (to which it is very closely allied) in North America; being found in thickets and hedges throughout the United States and Canada, and flowering in June and July. The fruit is dark purple or nearly black when ripe.

From the common English Elder, the chief differences are found in the larger and more compound leaves, the more loose cymes with larger flowers and bracts at the ramifications and the less arborescent habit. The stems indeed are often killed down in the winter. The plant has been grown in some botanic gardens in this country.

A. Gray, Man. Bot. N.U. States, p. 204; DC. Prod., iv, p. 322; Hook., Fl. Bor.-Am., i, p. 279.

Official Part and Name.—Sambucus; the flowers (U. S. P.). It is not official in the British Pharmacopœia, or the Pharmacopœia

of India; the flowers of Sambucus nigra being official in these Pharmacopœias instead of those of Sambucus canadensis.

General Characters and Composition.—The flowers of *Sambucus canadensis* which are official in the U. S. P. under the name of Sambucus or Elder, closely resemble in their characters and composition the official Sambuci Flores of the British Pharmacopœia and the Pharmacopœia of India, and which are described by us under *Sambucus nigra*. Thus, when fresh, they are small, white, and have a peculiar, agreeable odour, although less marked than in our Elder; this odour they retain when carefully dried, but they then become yellowish, and shrivelled in appearance. They have a bitterish taste.

The flowers yield by distillation a small quantity of *volatile oil*, which becomes of butter-like consistence on cooling. It has the odour of the flowers, is lighter than water, and has a very high boiling point. By exposure to the air it becomes altered in colour and other characters, but little is known respecting it; it requires further investigation. The flowers also contain various other constituents, but their properties would appear to depend entirely upon the volatile oil.

Medical Properties and Uses.—The properties of these flowers are the same as those of the official *Sambucus nigra* of the British Pharmacopœia, being gently stimulant and sudorific. They are also sometimes given in the United States, as a laxative in diseases of infants. In large doses the fresh flowers are said to cause nausea and diarrhœa. They are, however, but little employed except externally in the form of fomentation or poultice, as an application to parts affected with rheumatism, abscess, or other local cause of pain. As a cooling application to inflamed surfaces they are also used in the form of elder-flower water and elder-flower ointment. Elder-flower water is likewise employed as a menstruum in lotions; but its chief use is by the perfumer.

The inner bark, young leaf-buds, and expressed juice of the fresh root are said to be active cathartics. The fruits known as elder berries are diaphoretic and aperient, and are used like those of the common elder in this country in making wine.

U. S. Disp., by W. & B., p. 768; Stearn's Medicinal Plants of Michigan, in Proc. Amer. Pharm. Assoc. for 1858, p. 279; Stille's Therapeutics and Materia Medica, vol. i, p. 525; Watts' Dict. Chem., vol. v, p. 186.

DESCRIPTION OF PLATE.

Drawn from a specimen in the British Museum collected by Short in Ohio.

1. An inflorescence.
2. A leaf.
3. A flower.
4. Under surface of corolla.
5. An anther.
6. Calyx and pistil.

(3–6 enlarged.)

UNCARIA GAMBIR, Roxb.

N. Ord. RUBIACEÆ. Lindl., Veg. K., p. 761 (Cinchonaceæ); Le Maout & Dec., p. 483.

Tribe *Naucleeæ*.

Genus Uncaria,* *Schreb.* B. & H., Gen., ii, p. 31. Species 30, all tropical, one African, another South American, the rest Indian.

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139. Uncaria Gambier,† *Roxburgh, Fl. Ind.*, i, *p.* 517 (1832).

Syn.—Nauclea Gambir, *Hunter.*

Figures.—Trans. Linn. Soc. Lond., ix, t. 22, cop. in Hayne, x, t. 3, and Nees, Supp.; Berg, Charact., f. 340; Rumph., Herb. Amboyn., v, t. 34, f. 2, 3; Korthals, Verhandl. Natuur. Gesch. Nederlansch. Bezitt., 1839–42, Bot., t. 34.

Description.—A strong, shrubby climber; stems rather slender, slightly thickened at the nodes, cylindrical or somewhat angular, smooth. Leaves opposite, stalked, readily disarticulating; stipules two at each node, interpetiolar, ovate or oblong, entire, blunt, early caducous, leaving a linear scar after falling; blade 3 or 4 inches long, ovate or oblong-ovate, rounded at the base, suddenly narrowed into the attenuate apex, entire or with a very few wide crenatures, smooth on both surfaces. Flowers small, closely crowded on small, globular, hairy receptacles at the extremity of axillary peduncles about an inch long and of singular structure; these are smooth, laterally compressed, and taper from a broad base in their lower half; half way they are provided with a cup-like whorl of small bracts, and beyond this become slender, cylindrical, and finely silky; at the whorl of bracts is an articulation, and after the fall of the whole inflorescence at this point the broad lower portions become elongated, very hard, and curved into hooks, by which the plant climbs. Calyx woolly or silky, the tube united with the ovary, the limb divided into 5 lanceolate or triangular teeth. Corolla monopetalous, with a slender tube ½ inch long, widening upwards, and terminating in an open cup with 5 broadly

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* Name from *uncus*, hooked, in reference to the falcate peduncles.

† *Gambir* is the Malay name of the extract.

ovate segments, hairy externally, and with a tuft of hairs at the base of each segment within. Stamens 5, inserted in the throat of the corolla, filaments excessively short, anthers long, 2-celled, with pointed bases. Ovary inferior, 2-celled, style very long, protruding much beyond the mouth of the corolla and ending in a club-shaped stigma. Fruit about 1 inch long, on a long stalk, narrow-ovoid, tapering at each end, pericarp dry, splitting into two layers when ripe, and dehiscing vertically into two valves, the valves of the outer layer remaining attached at the apex. Seeds very numerous, minute, pale brown, rough, with a long, transparent tail at each end, one split almost to the base, the other entire.

Habitat.—This shrub is found in the Island of Pulo Penang, and other districts about the Straits of Malacca, also in Sumatra and in Ceylon, and is now cultivated in numerous and extensive plantations in the neighbourhood of Singapore. It appears that the curious axillary hooks are frequently produced without bearing any heads of flowers.

U. acida, Roxb., is figured in Berg and Sch., t. 33 e; it is said to differ from *U. Gambier* in possessing a more angular stem, deeply bifid stipules, and an acid taste in the leaves, and is also found at Pulo Penang. Probably it may be reduced to a variety of the species under notice.

Hunter, in Trans. Linn. Soc., ix (1808), p. 218; DC. Prod., iv, p. 347; Roxburgh, Fl. Indica, i, p. 517; Lindl., Fl. Med., p. 405.

Official Part and Name.—Catechu Pallidum; an extract of the leaves and young shoots (B. P.). An extract obtained from the leaves and young shoots (I. P.). Not official in the Pharmacopœia of the United States.

Uncaria acida, *Roxb.*, appears also to be used in the preparation of *Catechu pallidum*, but it is not official.

Commercial Kinds of Catechu.—The term *Catechu* is applied to various astringent extracts, of which the following three are more especially known in commerce :—1. *Gambier*, the one now to be described under the official name of *Catechu pallidum*; 2. *Cutch*,

Catechu of the Acacia Catechu, or *Catechu nigrum*, which is noticed under *Acacia Catechu*; and, 3. *Ceylon Catechu* or *Betel-nut Catechu*, which is described under *Areca Catechu*.

Preparation of Catechu Pallidum.—The Gambier or Gambir plant is largely cultivated at Singapore and in the Island of Bintang and other islands lying south-east of Singapore; and also to some extent in other parts. Gambier is prepared by boiling the leaves and young shoots in water until all their astringency is extracted; the decoction is then said to be evaporated to the consistence of a thin syrup, and put into buckets, and when sufficiently cool stirred in the following manner:—The workman pushes a piece of soft wood in a sloping direction into each bucket; and with two buckets before him he works a stick up and down in each. "The liquid thickens round the stick, and the thickened portion being constantly rubbed off, while at the same time the whole is in motion, it gradually sets into a mass, a result which, the workman affirms, would never be produced by simple stirring round." The thickened mass, which is described by Mr. Bennett as being of a light yellowish-brown colour, like clay, is now placed in shallow square boxes, and when sufficiently hardened is cut into cubes and dried in the shade. The process adopted is given somewhat differently by others; but in all cases the preparation is said to be conducted with the simplest apparatus.

Commerce.—Gambier is principally obtained from Singapore, from which port alone 37,352 tons were exported in 1872, of which about 25,000 tons were imported into Great Britain, representing a money value of about £450,000. It is also largely imported into the United States.

General Characters and Composition.—Gambier, Gambir, Pale Catechu, or *Terra Japonica*, under all of which names it is known, occurs in cubes, or in masses of variable size formed of more or less agglutinated cubes, or rarely, in quite compact masses. The separate cubes are about an inch square on each side, of a deep reddish-brown colour externally, and of a pale cinnamon-brown hue internally. They are dry and friable, and their fractured surface presents a dull, porous, earthy appearance, and hence,

under the impression originally that catechu was an earthy substance derived from Japan, it was called *terra japonica*. Catechu has no odour; its taste at first is bitter and very astringent, but subsequently sweetish. Under the microscope catechu is found to consist mainly of myriads of very small acicular crystals of *Catechin* or *Catechuic Acid*. It is entirely soluble in boiling water, and its decoction when cool is not rendered blue by iodine, indicating the absence of starch.

Pale Catechu has essentially the same composition as Cutch or Black Catechu from *Acacia Catechu;* thus, it mainly consists of *Catechin* or *Catechuic Acid*, and *Catechu-tannic Acid*. Like Cutch, Pale Catechu also contains a yellowish colouring matter, which has been named *Quercetin*.

Several other varieties of pale catechu have been described by Pereira and other pharmacologists, but they are generally more or less impure, and should not be used in medicine. They are now, moreover, but rarely imported.

Medical Properties and Uses.—Pale Catechu is especially valuable as an astringent. Its properties are similar to the Catechu obtained from *Acacia Catechu*, which is, however, preferred in the United States; but Pale Catechu is alone official in this country, and is also more commonly used in India. It is more readily soluble than that from *Acacia Catechu;* and is more powerful than kino. Pale Catechu is a valuable remedy in chronic diarrhœa and dysentery, in which cases it may be advantageously combined with opiates and chalk mixture. It may be also used in passive uterine hæmorrhages, and generally in mucous discharges. When chewed, or taken in the form of a lozenge, it is an excellent remedy in relaxed conditions of the uvula and palate, and for hoarseness in public speakers and singers. As a topical astringent it may be also applied in the form of an ointment to ulcers; and it is frequently very useful as an injection in bleeding of the nose and in leucorrhœa, &c.

Pale Catechu is also largely consumed in the East by the Betel-chewers, as it forms one of the ingredients in the famed masticatory called *Betel*.

By very far the largest consumption, however, of pale catechu is in tanning, dyeing, &c.

Per. Mat. Med., vol. ii, pt. 2, p. 152; Pharmacographia, p. 299; U. S. Disp., by W. & B., p. 242; Watts' Dict. Chem., vol. i, p. 816; Per. Mat. Med., by B. & R., p. 749; Collingwood, Journ. of Linn. Soc. Bot., vol. x (1869), p. 52; Garr., Mat. Med., p. 287; Pharm. Journ., 2nd ser., vol. vi (1865), p. 18.

DESCRIPTION OF PLATE.

Drawn from specimens in the British Museum collected at Malacca by Maingay (no. 827), and in Ceylon by Thwaites (no. 1661).

1. A flowering branch.
2. A flower.
3. Upper part of corolla laid open.
4. Stamens.
5. Vertical, and—6. Transverse section of ovary.
7. Fruit.
8. Seed.
9. Extremity of a young twig to show stipules.
10. The hooked peduncles after the fruit has fallen.

CINCHONA OFFICINALIS. *Linn.*

N. Ord. RUBIACEÆ.

Tribe *Cinchoneæ*.

Genus **Cinchona**,* *Linn.* B. & H., Gen., ii, p. 32; Triana, Nouv. Études sur les Quinquinas, p. 58. There are about 36 species, natives of the Andes of tropical South America.

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140. Cinchona officinalis, *Linn., Sp. Plant., ed.* 1, *p.* 172 (1753).

Peruvian Bark. Pale Cinchona Bark.

Syn.—C. Uritusinga, *Pavon.* C. academica, *Guibourt.* C. Condaminea, *Humb. & Bonpl.* C. Chahuarguera, *Pavon.* C. crispa, *Tafalla.*

Figures.—Mém. Acad. Paris, 1738, cop. in Woodville, t. 200; Nees, t. 260; Steph. & Ch., t. 183 (bad); Berg & Sch., tt. 14 c (*C. Uritusinga*) and 15 a (*C. Chahuarguera*); Humb. & Bonpl., Pl. Æquinoct., i, t. 10, cop. in Hayne, vii, t. 37; Bot. Mag., t. 5364; Weddell, Hist. Nat. Quinq., tt. 4, 4 bis (*C. Condaminea*); Howard, Ill. Nueva Quinol., 1st (*C. Chahuarguera*), 2nd (*C. crispa*), and 19th (*C. Uritusinga*) plates; Lambert, Desc. Cinch., t. 1; Howard, Quinol. E. Ind. Plant., t. 11 (var. *Bonplandiana*).

Description.—A tree reaching 35 feet and more in height (but often found as a shrub), with an erect, cylindrical, thick trunk, and a much branched, leafy crown; bark rough, brown, with black and whitish marks, yellow within, the youngest branches somewhat compressed, sulcate, slightly pubescent. Leaves opposite, spreading, evergreen, on short, smooth, cylindrical, reddish petioles; stipules interpetiolar, supra-axillary, as long as the petioles, ovate, acute, quite entire, pubescent, adpressed to the stem, quickly deciduous, leaving a linear scar; blade 4—5 inches long, varying from broadly oval to lanceolate, acute at both ends, quite entire, the margins usually recurved, quite smooth above and

* *Cinchona*; a name given by Linnæus in commemoration of the Countess Ana de Osorio, wife of the 4th Count of Chinchon, Spanish Viceroy of Peru. In 1638 she was cured of a tertian fever by the use of Peruvian Bark, and in 1640 brought back with her to Europe the valuable drug. It has been vigorously urged that the spelling of Linnæus's genus should be altered to *Chinchona*, but botanists generally are averse to making the change (see D. Hanbury, in 'Athenæum,' 30 Jan., 1875, p. 162; the last contribution to scientific literature of the lamented author).

bright green, paler and with the prominent veins finely pubescent beneath, with a faintly marked glandular hairy depression (scrobicule) at the angle of each primary lateral vein with the midrib, rather thin, flat or distinctly undulated, turning red when withering. Flowers of moderate size, shortly stalked, numerous, arranged in small cymes of 3 to 7 at the ends of the opposite branches of axillary and terminal peduncles, the whole inflorescence forming a large, broadly pyramidal panicle; bracts small, opposite, linear, acute; peduncles and pedicels finely pilose. Calyx small, the tube united with the ovary, teeth 5, triangular, acuminate, spreading, red, smooth, persistent and enlarged in fruit. Corolla $\frac{5}{8}$ inch long, erect, rose-coloured, pubescent externally, soon falling, with a long cylindrical tube and 5 oblong-lanceolate, short, spreading or recurved segments, fringed with a dense border of white, clavate, blunt hairs, valvate in æstivation. Stamens 5, inserted on the tube of the corolla and included within it; anthers linear, dorsifixed. Ovary inferior, 2-celled, with numerous imbricated ovules inserted on linear axile placentæ, crowned with a fleshy circular disk; style slender; stigmas 2, short, erect, papillose on their inner side. Fruit oblong-ovoid, about $\frac{3}{4}$ inch long, crowned by the persistent calyx-teeth; pericarp dry, smooth, longitudiually striate, reddish-brown, dehiscing septicidally from the base upwards into two chartaceous valves, which remain connected by the calyx above and the split pedicel below. Seeds numerous, imbricated, small, flattened, pale brown, surrounded by a broad, thin, somewhat lacerated wing; embryo with ovate cotyledons in the axis of fleshy endosperm.

Habitat.—This tree under several varieties is a native of the mountain slopes of the Andes, at an elevation of 6000 to 7500 feet, in the district of Loja (often spelt Loxa), on the confines of Peru and Ecuador, and in lat. about 4° S. The flowers appear in May to August, and, as in the other species, are sweet-scented.

Like all the members of this difficult genus, *C. officinalis* is very variable. One of the varieties is, without doubt, the "Quinquina" described and figured by De la Condamine in 1738, and also the tree which, a century earlier, afforded the "Jesuits' Bark," to

which the Countess Chinchon owed her cure. It is thus fixed as the *C. officinalis* of Linnæus, who founded his species on De la Condamine's plates and description. The variety which we have figured is the true *C. Uritusinga*, Pavon (*C. academica*, Guib.). Of this plant Mr. Howard received seeds from Don T. Riofrio, a

resident at Loja, collected in the Uritusinga Mountains of Ecuador, and successfully raised plants, one of which flowered in 1862-3, being the first Cinchona to blossom in England. From a photograph of this tree the accompanying woodcut is made. Mr. Howard believes this variety to be an unchanging type, and

recognisable by its undulated leaves, as well as by the characters of its bark, which is far more valuable than that of any other variety of this species.

The forms recognised as distinct by Howard are—1, *Uritusinga;* 2, *Condaminea;* 3, *Bonplandiana;* 4, *crispa.* The latter is maintained as a separate species by Weddell and Triana; and Triana also keeps *C. Chahuarguera* as a species distinct from *C. officinalis.* The botanical differences are but slight, depending chiefly on the leaf-form. That these are not reliable for characters is evidenced by the fact that in plants raised from seed taken from a single capsule differences in the shape of the leaves have been observed as great as those upon which such species have been founded.

This tree has, it is said, become nearly extinct in its native regions, but we are no longer dependent upon South America for Cinchona products. There are immense plantations in the Nilgiri Hills of Madras, in the Sikkim Himalayas, and elsewhere in India and in Ceylon, also very extensive ones in Java, and good progress is being made in Jamaica. So far as our Indian plantations are concerned the whole is the work of the last twenty years; with the introduction of the trees will always be connected the names of Clements Markham, Spruce, Cross, and others, and with their management under cultivation that especially of the late W. G. McIvor; the whole history is an interesting one of great difficulties successfully surmounted. In the most important of the Nilgiri plantations at Ootacamund, which are at an elevation of 6000 to 7000 feet, the present species, *C. officinalis,* is found to succeed best.* It is, however, very variable, more than a dozen distinct forms being there cultivated. From a plant of the var. *Uritusinga* sent out by Mr. Howard over 60,000 trees have been raised, and the whole number in the Government plantations in the Nilgiris alone is now to be reckoned by millions. The propagation by seed is indeed very rapid, and the trees grow fast. It is probable that a great deal of accidental crossing has occurred, and that many of the varieties are hybrids.

* A photograph of a plantation of this species is given in Howard's 'Quinology of Indian Plantations.'

De la Condamine, in Mém. de l'Acad. des Sciences, Paris, 1738, p. 226; Humboldt, Plant. Æquinoct., i, p. 33; Weddell, in Ann. Sc. Nat., ser. 5, xii, p. 24 (1870); Lindl., Fl. Med., p. 414; Hook. f., in Bot. Mag., t. 5364; Howard, Quinol. E. Ind. Plantations, p. 82; Id., in Journ. Linn. Soc., xiv, p. 160; Flück. & Hanb., Pharmacogr., p. 302; Triana, Nouv. Études sur les Quinquinas, p. 59.

Official Part and Names.—CINCHONÆ PALLIDÆ CORTEX; the bark of Cinchona Condaminea, *D.C. vars.* Chahuarguera, *Pavon,* and crispa, *Tafalla* (B. P.). The bark of Cinchona Condaminea, *D.C. vars.* C. Chahuarguera, *Pavon,* and C. crispa, *Tafalla* (I. P.). CINCHONA PALLIDA; the bark of Cinchona Condaminea, *Humb. & Bonpl.* and of Cinchona micrantha, *Ruiz* et *Pavon* (U. S. P.). It is commonly known under the names of Pale Cinchona Bark, Pale Cinchona, Pale Bark, Loxa or Loja Bark, and Crown Bark. It should also be noticed that the official Pale Bark of the United States Pharmacopœia also includes the kind of bark which is derived from *Cinchona micrantha,* a bark which was formerly official in the Edinburgh and Dublin Pharmacopœias under the name of *Cinchona cinerea,* and which is known in commerce as *Grey* or *Huanuco Bark.* It is also interesting to note that the variety known as *Chahuarguera* " is really the *Quina primitiva,* as having been traditionally the one which cured the Countess of Chinchon."

Collection, Cultivation, and Commerce.—The official pale bark is stated in the British Pharmacopœia to be collected about Loxa, in Ecuador. It is imported from Loxa in chests, and after its arrival—as various kinds of quilled barks are imported under the name of Loxa or Crown Bark, mixed, or sometimes unmixed—it is commonly picked and sorted. At the present day it is scarcely possible, however, to obtain genuine Loxa or Crown Bark from its native country. But the plant yielding it is now extensively cultivated in India, Ceylon, and Java, and our supplies are annually increasing from these countries.

General Characters and Varieties.—Several varieties of Pale Cinchona Bark, which vary much in their general characters and composition, have been found in commerce, but they are all found only in the form of quills. The general characters of this bark as

given in the British Pharmacopœia are as follows:—From half a line to a line thick, in single or double quills, which are from six to fifteen inches long, two to eight lines in diameter, brittle, easily splitting longitudinally, and breaking with a short transverse fracture; outer surface brown and wrinkled, or grey and speckled with adherent lichens, with or without numerous transverse cracks; inner surface bright orange or cinnamon-brown; powder pale brown, slightly bitter, very astringent.

The more important varieties of this bark which have been distinguished by pharmacologists are:—1. *Original* or *Old Loxa Bark*, of Pereira, from *Cinchona Uritusinga*, of Pavon; the *Cinchona officinalis*, var. *Uritusinga*, as now defined: 2. *Rusty Crown Bark*, from *Cinchona Condaminea*, var. *Chahuarguera*, Pavon; the *Cinchona officinalis*, var. *Condaminea*, How.: 3. *H. O. Crown Bark* or *Yellow Crown Bark*, which is said to be obtained from *C. Chahuarguera*, Pavon, var. *Cascarilla Amarilla del Rey*, or partly, as now defined, from *C. officinalis*, var. *Bonplandiana lutea*, of Howard: 4. *Red Crown Bark*, which is stated to be the produce of *C. Condaminea*, var. *Cascarilla Colorada del Rey*, or as now referred commonly, to *C. officinalis*, var. *Bonplandiana colorata*, of Howard: and 5. *Fine Crown Bark*, the *Silvery Crown Bark* of Pereira, from *Cinchona Condaminea*, var. *crispa*; the *C. crispa*, of Tafalla, and the *Cinchona officinalis*, var. *crispa*, How. All these kinds of Pale Bark are obtained from varieties of the plant now under description; but they do not include the kind of Pale Bark of the Pharmacopœia of the United States, which is derived from Cinchona micrantha, *Ruiz* et *Pavon*. The only varieties it will be necessary for us to refer to, are *Rusty Crown Bark* and *Fine Crown Bark*, which are those more especially described in the British Pharmacopœia.

1. *Rusty Crown Bark.*—This is the *Huamalies Bark* of Pereira; but not of Guibourt and Bergen. The larger quills represent the *Quinquina noueux* of Joseph de Jussieu. It occurs in variously-sized quills, which are striated or furrowed longitudinally, and nearly or entirely devoid of transverse cracks. These quills have a rusty-brown colour; the smaller quills being marked by small

brown spots, and the larger ones by rusty-coloured warts, which when numerous are disposed in irregular longitudinal lines, and are sometimes split like a coffee berry. In odour rusty crown bark resembles fine crown bark, which has been compared by Guibourt to that of tobacco.

2. *Fine Crown Bark.*—The source and synonyms of this bark have been already alluded to. It is also the *quina crespilla* or *carrasquena* of the older botanists, and the *quina fina de Loxa* of modern commerce. Specimens of fine crown bark gathered by Seemann at Loxa, from *Cinchona Condaminea*, var. *a. vera* of Weddell, and presented to Pereira, were regarded by him as identical with this bark. Fine crown bark is in slender quills, has a silvery appearance externally from the presence of adherent crustaceous lichens, is marked with numerous transverse cracks, and has a brittle vitreous fracture.

Composition.—The analyses of Howard show that the different varieties of Loxa or Crown bark vary very much in the proportion of alkaloids they contain. Thus the *original* or *old Loxa bark* yielded him an amount of alkaloids equalling the total obtained from some specimens of the official Calisaya bark. In the larger and thicker *rusty crown* he found from 2 to 3 per cent. of alkaloids, chiefly cinchonidia, but also more or less quinia. In the *yellow* and *red crown* varieties he also found cinchonidia associated with traces of quinia and cinchotannic acid. A very fine specimen of *fine crown* yielded 1½ per cent. of cinchonidia and quinia, with much cinchotannic acid; but on an average specimens of this bark only yielded him from 0·50 to 1 per cent. of alkaloids. According to the British Pharmacopœia, 200 grains of Pale Cinchona bark should yield not less than 1 grain of alkaloids.

Specimens of pale bark from India yielded Howard varying proportions of alkaloids, thus from about 4·30 to 6·40 per cent. The principal alkaloid obtained was quinia, then next in order cinchonidia, cinchonia, and quinidia. Further particulars of the composition of Cinchona barks are given under Cinchona Calisaya.

Grey or Huanuco Bark.—Under the head of *Cinchona Pallida*, in the Pharmacopœia of the United States, this bark is included,

as already noticed, with the varieties of bark from *Cinchona officinalis,* already described. Its botanical source is there stated to be from *C. micrantha,* R. et P.; but it is also derived from *C. nitida,* R. et P., and *C. peruviana,* Howard. These plants are natives of Peru, and are now cultivated in India. Grey bark is also known as Lima Bark. It is but little used in this country, but is chiefly consumed on the Continent. Two varieties have been described by Pereira, under the names of *fine grey bark,* from *C. nitida;* and *coarse* or *inferior grey bark,* from *C. micrantha.* The latter is also sometimes known as *Peruvian Calisaya.* The names of grey and silver bark are applied to this bark from the colour given to it by various lichens; and that of Huanuco is derived from the neighbourhood in which it is collected. When of good quality it is a valuable bark. Its chief constituent is cinchonia, but some varieties also contain a good proportion of quinia. For a further description of the varieties of this bark we must refer to special treatises on materia medica.

Medical Properties and Uses.—The properties and uses of Cinchona barks are given in detail in our article on *Cinchona Calisaya.*

Per. Mat. Med., vol. ii, pt. 2, pp. 98, 100, and 102; Per. Mat. Med., by B. & R., p. 715–719; Pharmacographia, p. 315; U. S. Disp., by W. & B., p. 275; Howard, Quinology of the East Indian Plantations, p. 2; Howard, in Proceedings of the International Botanical Congress of London, 1866, p. 195; Holmes, Catalogue of the Collections of the Museum of the Pharmaceutical Society, pp. 60, 61, and 80; Howard, in Pharm. Journ., vol. xiii, ser. 1, p. 671., vol. xiv, p. 63., vol. viii, ser. 2, p. 15., vol. v, ser. 3, p. 1005.

DESCRIPTION OF PLATE.

Drawn from a specimen in the British Museum from the Ootacamund Plantations, and from a young plant in cultivation (1879) by Mr Howard (var. *Uritusinga*). 1. A flowering branch. 2. A flower. 3. Capsule after dehiscence. 4, 5. Seeds. (2, 5 enlarged.)

CINCHONIA CALISAYA *Wedd.*

N. Ord. Rubiaceæ.

Tribe *Cinchoneæ*.

Genus Cinchona, *Linn.*

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141. Cinchona Calisaya,* *Weddell, in Ann. des Sciences Nat., ser.* 3, X, *p.* 6 (1848).

Calisaya Bark. Yellow Cinchona Bark.

Syn.—C. Weddelliana, *Kuntze*, non *Miquel.*

Figures.—Wedd., Hist. Nat. Quinquinas, tt. 3, 3 bis; Berg & Sch t. 14 d; Bot. Mag., t. 6052 (var. *Josephiana*); Howard, Quinology of E. Ind. Plantations, tt. 4–6 (var. *Ledgeriana*), 7, 8 (var. *Calisaya Javanica*), 9 (var. *Josephiana glabra*), 15 (var. *microcarpa*).

Description.—A large tree, with a straight bare trunk, and frondose crown; bark thick, whitish, fissured, smooth and darker on the branches. Leaves shortly stalked, spreading, 3—8 inches long, oval- or obovate-oblong, obtuse at the apex, tapering at the base into the petiole, quite entire, glabrous and bright pale green above (often tinged with crimson), paler and glabrous or very finely pubescent beneath, slightly scrobiculate in the axils of the veins; stipules longer than the petioles, glabrous, oval-oblong, very obtuse, pale green, soon falling. Flowers as in the last species, but less numerous, and forming a less pyramidal panicle. Corolla somewhat shorter, flesh-coloured or rosy. Capsule ovate, usually not more than about ½ inch long, not ribbed, smooth; the rest as in *C. officinalis.*

Habitat.—This valuable species was discovered by the late Dr. Weddell in 1847. It grows in the valley forests on the borders of Bolivia and South Peru (province of Carabaya), in lat. 13°—16° S., and at an elevation of 4500—5400 feet, flowering from January to April.

Like the last this has proved to be a very variable species, but it is generally to be recognised by its obtuse leaves. The most distinct variety is that called *Josephiana* (after Joseph de Jussieu,

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* *Calisaya* is one of the names for the bark used by the Spaniards and Indians.

who first described it in MS.), which Weddell considers a distinct species. This forms only a small shrub, the leaves are less obtuse and the flowers usually white. The figure in the Bot. Mag. was drawn from a plant which flowered in Oct., 1872, with Mr. Howard; he does not accord it specific rank, believing that he has grown it from seed of true *C. Calisaya*.

The other varieties given by Weddell are *microcarpa, boliviana, oblongifolia,* and *pallida,* but the distinctions are difficult to mark. There are many intermediate forms, and, indeed, variations even with seed from the same capsule is very great. The plant figured in the Journal of Botany for 1869, t. 87, which certainly yielded a "Calisaya" bark, may be another variety.

But altogether the best variety for yield of Quinine is var. *Ledgeriana,* named after Mr. C. Ledger, who in 1865 obtained the seed from the province of Caupolican, Bolivia. This has rather small, narrow, oval-oblong, obtuse leaves. Our plate represents a form (allied to *Ledgeriana*) which flowered in January, 1879, with Mr. Howard, at Tottenham, the tree being about 7 years old.

As regards the cultivation of this species, *C. Calisaya* has been found to succeed better than any other species in the Dutch plantations in Java. The variety *Ledgeriana* is now especially grown both there and in our Indian plantations at Ootacamund and in Sikkim. The var. *Josephiana* is quite useless for cultivation and incapable of improvement.

Weddell, in Ann. Sc. Nat., ser. 5, xii, p. 52; Id., Hist. Nat. Quinq., p. 30; Triana, Nouv. Études sur les Quinq., p. 63; Howard, in Journ. Linn. Soc., xiv, p. 166; Id., Quinology of E. Ind. Plantations, p. 84.

Official Parts and Names.—1. CINCHONÆ FLAVÆ CORTEX; the bark (B. P.): 2. QUINIÆ SULPHAS; the sulphate of an alkaloid prepared from Yellow Cinchona bark, and from the bark of Cinchona lancifolia, *Mutis* (B. P.). 1. The bark (*Cinchonæ flavæ Cortex, Cinchona flava*): 2. The sulphate of an alkaloid prepared from Yellow Cinchona bark, and from the bark of Cinchona lancifolia, *Mutis* (I. P.). CINCHONA FLAVA; the bark (U. S. P.). This bark is frequently distinguished under the name

of Calisaya Bark ; and is also commonly known as Yellow Cinchona Bark and Yellow Bark.

1. Cinchonæ Flavæ Cortex ; or Cinchona Flava.—*Collection, Preparation, Cultivation, and Commerce.*—In the British Pharmacopœia, and in the Pharmacopœia of India, Yellow Cinchona Bark is said to be collected in Bolivia and South Peru, where, as already noticed, this tree is a native. It was formerly imported in serons, and principally from Arica, the nearest Peruvian port to the Bolivian district of La Paz, where it was principally collected ; but the supply of Calisaya bark, from its native habitats, is, at the present time, very uncertain. This species is, however, now cultivated in India, principally in the Neilgherry Hills, on the south-west coast of India, in the Madras Presidency ; and in the valleys of the Himalaya in British Sikkim. But its cultivation has not been hitherto so successful in India, as that of *Cinchona succirubra* and *C. officinalis*, although recent accounts have been more favourable. For its introduction into India, as well as that of other species of Cinchona, we are more particularly indebted to Mr. Markham. This species has also been cultivated most successfully in Java ; and to some extent in Ceylon, Jamaica, and other warm parts of the world.

The importance of Cinchona barks in medicine renders it necessary for us to give some account of the manner in which they are collected and dried in their native forests ; and prepared for exportation. The following notice has therefore been condensed chiefly from Weddell, and refers more especially to the bark now under description, as formerly collected in the forests of Carabaya, in the valley of San Juan del Oro, in Peru.

The name of *cascarilleros* (bark-peelers) is given, not only to the peelers, but to all who are engaged specially in the collection and commerce of cinchona barks. The bark is gathered at all times of the year, except during the rainy season. The *cascarilleros* are accompanied into the forests by a confidential person called the *major domo*, whose duty it is to receive and examine the barks brought to him by the different parties who are employed in the forests in the collection of the bark.

The first thing done by those who engage in this work in a region previously unexplored, is to have the district examined by experienced cascarilleros. The duty of these is to penetrate the forests in different directions, and to ascertain to what points they may be profitably explored. If their report be favourable, a road is immediately commenced up to a point which is to form the centre of the operations; and the major domo with his cutters pitches his camp in the neighbourhood, and the cascarilleros are distributed through the forest one by one, in small parties, to discover the cinchona trees, which, having succeeded in doing, they proceed to collect the bark. For this purpose, in the first place, in order to strip the tree of its bark it is felled with a hatchet, a little above the root, the bark having been previously removed from this part, so that nothing may be lost; and as at the base the bark is thickest, and, therefore, most profitable to collect, it is customary to remove the earth from around the trunk, so that the barking may be more complete.

When the tree is down, and the useless branches have been cut off, the periderm or outer coating of the bark is removed by striking it with either a little wooden mallet, or the back of the hatchet used in felling the tree; and the inner bark, being thus exposed, is often further cleaned by means of a brush. The bark is then divided by uniform incisions circumscribing the pieces which are to be removed. These are afterwards separated from the trunk with a common knife or some other instrument, for which purpose on being introduced into the incisions the point of the knife is carried as closely as possible to the surface of the wood, and the bark then peeled off. The dimensions and regularity of the pieces necessarily depend more or less on circumstances; in general, however, for the convenience of transport and facility of preparation, they endeavour to make them from fifteen to eighteen inches long, and four to five inches wide. The bark of the small trunks and branches is separated in the same way as that of the large trunks, excepting that the periderm is not removed from these.

The details in the process of drying also vary slightly in the

bark derived from the large trunks and that from the small trunks and branches. Thus the pieces of bark from the branches and small trunks, which are intended to make *quilled bark*, are simply exposed to the sun's rays, and they then take of themselves the desired form, which is that of a hollow cylinder; but the bark derived from large trunks which is to constitute *flat cinchona*, must necessarily undergo a certain degree of pressure during the process of drying, without which it would become misshapen, or take a more or less quilled form, as in the preceding case. To effect this, after exposing the pieces of bark to the sun, they are placed one on the other in crossed squares, in a similar manner to that practised in timber yards in the arrangement of the planks of wood; and on the top of this pile a heavy weight is placed. This process is repeated for several days, until the bark is completely dried. But the labour of the cascarillero is by no means ended when he has finished the preparation of the bark; he has yet to carry it to the camp, and, with a heavy load on his shoulders, he has therefore to retrace his steps along those parts which, while unburdened, he traversed with difficulty.

As the cutters bring in the bark to the major domo he submits it to a slight examination, and rejects that which is bad. It is then, if necessary, exposed to a fresh process of desiccation, and formed into bundles of nearly equal weight, which are sewn up in coarse canvas kept for that purpose. In this condition the bundles are conveyed on the backs of men, donkeys, or mules, to the depôts in the towns, where they generally receive an exterior envelope, consisting of a fresh hide, which, as it dries, makes a hard and compact package. In this form the packages are known by the name of *serons*, and it is thus that they arrive in Europe and elsewhere. The usual weight of a seron is from 156 to 176 pounds avoirdupois; but it is sometimes much less than this.

The above remarks on the collection and preparation of Cinchona barks apply more especially to the bark now under description. But other barks are imported either wholly in *chests*, as the official Pale and Red Cinchona barks; or partly in chests, and partly in serons. The mode of collecting and pre-

paration also varies in some minor particulars in the different bark districts.

General Characters and Varieties.—The following general characters are given of Calisaya bark in the British Pharmacopœia :— In flat pieces, uncoated or deprived of the periderm, rarely in coated quills, from six to eighteen inches long, one to three inches wide, and two to four lines thick, compact and heavy; outer surface brown, marked by broad shallow irregular longitudinal depressions; inner surface tawny-yellow, fibrous; transverse fracture shortly and finely fibrous. Powder cinnamon-brown, somewhat aromatic, persistently bitter.

Two varieties are distinguished in commerce—*quilled* and *flat*. 1. *Quilled Calisaya.*—This bark is commonly coated, and occurs in single quills. The coat varies in thickness. It is more or less rough, and is marked with transverse impressions, furrows, or cracks, which often form complete rings around the quills, the edges of which are thick, raised, and everted. When the coat is very thick it has a somewhat corky texture, and the annular furrows form deep incisions. Between the rings there are longitudinal wrinkles and cracks. These furrows and cracks, especially in the larger quills, give the bark a very rough appearance, which is one of its marked characteristics. The coat is nearly tasteless. Its colour is naturally brown, but it is often rendered more or less silvery or grey by the crustaceous lichens with which it is covered. The derm or uncoated portion consists chiefly of liber, whose taste is very bitter and slightly astringent. It has a deep cinnamon-brown colour internally, and its fracture is finely fibrous. 2. *Flat Calisaya.*—The pieces of this bark are flat, or nearly so, as their name implies. They are generally uncoated, consisting almost entirely of liber, which is sometimes a third or even half an inch thick. Their texture is compact and uniform; and their transverse fracture is finely fibrous, the fibres being short and readily detached, so that when this bark is handled it causes much irritation. Externally the colour is slightly brownish tawny-yellow, frequently interspersed with darker patches; and the surface is marked by shallow, longitudinal depressions, which are commonly

termed *digital furrows*. Internally the surface has a wavy, fibrous appearance, and a yellowish tawny colour. The taste is very bitter—the bitterness being gradually developed on chewing,—with a very feeble astringency.

The bark of the root is readily known from that of the trunk and branches by occurring in short, more or less curved or twisted pieces.

Calisaya bark is the best of all the cinchona barks; but little, however, is now obtained from South America, our supplies being chiefly derived from plants under cultivation in India and Java. One variety of *Cinchona Calisaya*, which has been more especially cultivated in Java, and known as var. *Ledgeriana*, yields a bark of extraordinary richness in alkaloids. The cultivation of this variety is now being extensively tried in India.

Adulterations and Substitutions.—Various barks, both quilled and flat, which more or less resemble the corresponding varieties of Calisaya bark, and of varying qualities, are met with in commerce; the description of these, however, does not come within our province. The best and readiest means of testing their value is to ascertain, by appropriate means, their yield of the more important alkaloids found in cinchona barks.

Composition.—Calisaya bark is remarkable for the large amount of the alkaloid quinia which it contains, good qualities yielding at least 5 to 6 per cent. of this alkaloid. The test of its goodness, as given in the British Pharmacopœia, is, that 100 grains should yield not less than 2 grains of nearly pure quinia. We must now allude generally to the composition of Cinchona Barks.

Composition of Cinchona Barks.—The most important constituents of the Cinchona barks are the alkaloids; these are also peculiar to the genus Cinchona. The principal of these are *Quinia* or *Quinine*, *Quinidia* or *Quinidine*, *Cinchonia* or *Cinchonine*, *Cinchonidia* or *Cinchonidine*, and *Quinaminia* or *Quinamine*. Other alkaloids, to which the names of *Paracine*, *Aricine*, *Cinchovatine*, and *Cusconine*, have also been indicated as constituents of Cinchona barks, but nothing definite is known respecting them.

By carefully heating solutions of the alkaloids of the cinchona barks with an excess of some mineral acid, Pasteur first succeeded in obtaining amorphous modifications of the same bases, having the same composition, *Quinia* and *quinidia* thus affording *quinicia;* and *cinchonia,* and *cinchonidia* yielding *cinchonicia.* These amorphous alkaloids are always formed in manufactories by the processes adopted for the separation of the alkaloids from cinchona barks; but they also appear to exist naturally in the living plant.

The substance called *quinoidine* or *chinioidin,* which was first noticed by Serturner, and regarded by him as a peculiar uncrystallizable alkaloid, is now known to consist essentially of a mixture of the amorphous alkaloids just alluded to. It may be readily obtained by precipitating with ammonia the brown mother liquors from which the crystalline alkaloids have been extracted. As thus derived it is a dark brown brittle substance, with a slight alkaline reaction; but its combinations with sulphuric and hydrochloric acids are now obtainable in the form of nearly colourless powders.

The green compound which is produced when solutions of quinia or its salts are mixed with chlorine water, and then a drop of ammonia added, has been termed *thalleioquin* or *dalleiochine;* it is the most characteristic test for ascertaining the presence of quinia.

The consideration of the properties of these alkaloids does not come within our province, but for all details on these points we must refer to special works on Chemistry and Materia Medica. We may, however, extract the following summary of their more important characters from Pharmacographia:

a. Hydrated crystals are formed by . .	Quinine, Quinidine.
No hydrated crystals by . . .	Cinchonine, Cinchonidine, Quinamine.
b. Abundantly soluble in ether . .	Quinine, Quinidine, Quinamine, and the amorphous alkaloids.
Sparingly soluble in ether . .	Cinchonidine.
Almost insoluble in ether . .	Cinchonine.
c. Levogyre solutions afforded by . .	Quinidine, Cinchonidine.

	Dextrogyre solutions by . . .	Cinchonine, Quinidine, Quinamine, and the amorphous alkaloids.
d.	Thalleioquin *is formed* by . . .	Quinine, Quinidine, and also by Quinicine.
	Thalleioquin *cannot be obtained* from .	Cinchonine, Cinchonidine, Quinamine, nor from Cinchonicine.
e.	Fluorescence *is displayed* by solutions of	Quinine, Quinidine.
	No fluorescence by solutions of pure .	Cinchonine, Cinchonidine, Quinamine.

The above alkaloids are combined in the barks with certain acids, known as *kinic* or *quinic acid, cincho-tannic acid,* and *kinovic, quinovic,* or *chinovic acid.* Cinchona barks also contain the substances known as *quinovin* or *chinovin,* and *cinchona-red, red cinchonic,* or *cincho-fulvic acid,* together with many other substances common to various kinds of barks, besides those now being treated of.

2. Quiniæ Sulphas.—No other alkaloid except quinia, or any salt of the cinchona alkaloids is official in the British Pharmacopœia, or the Pharmacopœia of India, except *Sulphate of Quinia;* but in the Pharmacopœia of the United States, *Valerianate of Quinia* is also official. Formulæ for the preparation of sulphate of quinia are given in the different pharmacopœias, to which our readers are referred, such being beyond our province; all that we can do is to give the characters and tests of Sulphate of Quinia, as follows:— Filiform silky snow-white crystals, of a pure intensely bitter taste, sparingly soluble in water, yet imparting to it a peculiar blueish tint. The solution gives with chloride of barium a white precipitate insoluble in nitric acid, and when treated first with solution of chlorine and afterwards with ammonia it becomes of a splendid emerald-green colour. Dissolves in pure sulphuric acid with a feeble yellowish tint, and undergoes no further change of colour when gently warmed. Ten grains with ten minims of diluted sulphuric acid and half a fluid ounce of water form a perfect solution, from which ammonia throws down a white precipitate. This redissolves on agitating the whole with half a fluid ounce of ether,

without the production of any crystalline matter floating on the lower of the two strata, into which the agitated fluid separates on rest. Twenty-five grains of the salt should lose 3·6 grains of water by drying at 212°.

Adulterations.—On account of its high price, and from other circumstances, sulphate of quinia is liable to many adulterations and impurities. Amongst the organic substances which have been detected are the sulphates of cinchonia and quinidia, salicin, phloridzin, sugar of milk, cane sugar, mannite, gum, starch, and stearic and other fatty acids; and sulphate of lime, salts of ammonia and of soda, chalk, magnesia, and boracic acid, are amongst the most frequent inorganic impurities. The characters and tests of the British Pharmacopœia as given above, are sufficient to determine its purity.

Medical Properties and Uses of the Cinchona Barks and their Alkaloids.—The cinchona barks possess powerful antiperiodic, tonic, antiseptic, and astringent properties. The three first qualities are especially due to their alkaloids; and the latter to cinchotannic acid and cinchona-red. The essential difference therefore, between the action of the alkaloids and their salts, and of the cinchona barks, rests in the astringency of the latter. The alkaloids cannot therefore, in all cases, be substituted for the barks, for it is a well-ascertained fact, that there are cases which can be successfully treated by the preparation of the barks, when the salts of the alkaloids have failed to afford relief. This difference of effect is doubtless due in some instances to the astringent properties of the barks; but also in others, to causes not yet explained. Again, although the barks are applicable in all cases where the alkaloids have been found useful, they are apt when administered in large doses, to produce severe irritation of the stomach and bowels, and thus to cause nausea, or even vomiting and purging; they are also liable to cause constipation by their astringency. Hence, as antiperiodics, and in other cases, where large doses of the preparations of the barks are required to produce the desired effects, the salts of quinia or of the other alkaloids, are, as a general rule, much better adapted for use. As tonics, the barks in small

doses, are extensively employed in cases of debility, more especially if this be caused or accompanied by profuse discharges, as colliquative sweating or diarrhœa, or by other mucous or purulent discharges, as leucorrhœa, abscesses, &c. Garrod says that, "as a tonic, in cases of great debility with weak heart, bark is more agreeable and beneficial than quinine;" and also, that "the astringent property of bark renders it better fitted for the treatment of relaxed conditions of the habit than quinine." The preparations of bark are also most useful after surgical operations when the strength has been greatly reduced; and in all cases of physical exhaustion, as in convalescence after either acute or lingering chronic diseases, unless there be much irritability of the stomach or bowels, or inflammatory, or febrile symptoms, when their use is contra-indicated. The preparations of the different barks will, of course, vary a good deal in their efficiency, according to the proportion of alkaloids which the barks contain; those of Calisaya bark are most to be trusted.

Powdered bark is sometimes sprinkled over the surface of unhealthy ulcers, &c., in which case it acts as an astringent and antiseptic. Powdered bark may also be used as a dentifrice in spongy conditions of the gums. The infusion or decoction of bark, with the addition of a mineral acid, is also a useful gargle in putrid sore throat.

The alkaloid quinia possesses in an eminent degree the tonic and antiperiodic properties of the cinchona barks. Its especial value in certain diseases over the crude barks has been already referred to in treating generally of their properties and uses. As an antiperiodic, quinia acts as a specific in ague and every form and type of intermittent fever, provided that it be administered in full doses; but it is of far less value in remittent fevers, although even here, when given in large doses at an early stage of an attack, it is sometimes a most efficacious remedy. In continued fevers it is comparatively little employed, although in some low typhoid cases, its effects have been very beneficial. In all diseases of an exhausting nature, such as malignant scarlatina, smallpox, gangrene, erysipelas, carbuncle,

hectic of phthisis, dysentery, typhoid pneumonia, and many others, quinia is also a valuable remedy. In all neuralgic and rheumatic affections, and others of a regular recurring character, sulphate of quinia is about the most effectual remedy we possess. As a tonic, quinia may also be administered with great advantage in cases of debility, as referred to in speaking of the properties and uses of the cinchona barks. In large doses quinia has also been found of great value in puerperal and surgical septicæmia, and in other affections caused by a septic condition of the blood. It has also the effect of checking the tendency to suppuration in various tissues and organs during acute inflammation. In fact, there is perhaps no remedy, except opium, which has been employed in such a variety of cases as sulphate of quinia.

In some instances large doses of quinia, and even of the preparations of cinchona barks, give rise to symptoms, to which the name of *quinism* or *cinchonism* has been applied, such as buzzing in the ears, deafness, headache, vertigo, nausea, &c. Usually after two or three hours these symptoms gradually decline, except the headache and nausea, which remain for a much longer period; and sometimes there is danger of permanent deafness and blindness being produced.

The almost exclusive use of quinia, more especially in the form of its official sulphate, has led to the nearly entire neglect of the other alkaloids of the cinchona barks; but from trials of their properties and uses which have been made of late years, it has been shown that their effects are similar to those of quinia, for which, therefore, they may be, as a general rule, economically substituted. Garrod states that he has repeatedly cured ague with quinidia, cinchonia, and cinchonidia. From experiments made by the Madras Cinchona Commission on the comparative antiperiodic power of the four alkaloids, it appears that the sulphates of quinia and quinidia are about equal in value; that sulphate of cinchonidia is only slightly less efficacious; and that sulphate of cinchonia, although somewhat inferior to the others, is still a most valuable remedy. More recent experiments substantially lead to the same results; and we may therefore conclude,

generally, that although quinia is, on the whole, the most valuable of the alkaloids, there is no reason why the use of the other alkaloids should be discarded.

Per. Mat. Med., vol. ii, pt. 2, p. 86; Per. Mat. Med., by B. & R., p. 712; Pharmacographia, p. 320; U. S. Disp., by W. & B., pp. 280, 294, and 1372; Garr., Mat. Med., p. 279; Royle, Mat. Med., by J. Harley, p. 566; Pharmacographia, p. 328, for list of modern works relating to Cinchona; J. E. Howard, in Pharm. Jl., ser. 2, vol. viii, p. 11; Flückiger, in Pharm. Jl. ser. 3, vol. ii, p. 900, and De Vry, p. 945; J. E. Howard, in Pharm. Jl., ser. 3, vol. iv, p. 21; J. E. Howard, Year Book of Pharmacy (1877), p. 514; Year Book of Pharmacy (1877), p. 266, from New Remedies, vol. v, p. 386; D. Howard, in Pharm. Jl., ser. 3, vol. viii, p. 1; Wood, in Pharm. Jl., ser. 3, vol. viii, p. 621; Year Book of Pharmacy (1878), pp. 62, 187, 285, 354, 547, and 550.

DESCRIPTION OF PLATE.

Drawn from a specimen in cultivation by Mr. Howard at Tottenham, near London; the fruit added from a specimen in the British Museum.

1. A branch with leaves and flowers.
2. Corolla laid open.
3. Calyx and pistil.
4. Capsule.
5, 6. Seeds.
7. A full-grown leaf.

(2, 3, 6 enlarged.)

CINCHONA SUCCIRUBRA. *Pavon.*

Hanhart imp.

N. Ord. Rubiaceæ.
Tribe *Cinchoneæ*.
Genus Cinchona, *Linn.*

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142. Cinchona succirubra,* *Pavon, ex Klotzsch in Abhandl. der Königl. Akad. Wissen. zu Berlin*, 1857, *p.* 60 (1858).

Red Cinchona Bark.

Syn.—C. Howardiana, *Kuntze.*

Figure.—Howard, Ill. Nueva Quinologia, 8th plate.

Description.—A tree said to reach 50—80 feet in height, but more usually not more than 20—40 feet, with an erect trunk and a frondose head; bark brown, with a few whitish markings, transversely cracked; young branches pubescent. Leaves on longish, pubescent petioles, flat above; stipules oblong, obtuse, nearly glabrous, caducous; blade 3—6 inches or more long, rounded ovate or broadly oval, acute or subobtuse at the apex, rounded or slightly tapering at the base, quite entire, thin, glabrous, dark green and shining above, much paler and finely pubescent on the leaves beneath, but without scrobicules. Inflorescence and flowers as in the other species. Fruit variable in form, ¾ to 1½ inches long. Seed as in the others.

Habitat.—It appears that this tree was formerly commonly met with in the province of Huaranda, in Ecuador, but it has been long becoming scarcer, and is now only found on the western slopes of Chimborazo, near Guayaquil, in lat. 1°—2° S., where it grows in stony declivities at an elevation of 2500—5000 feet. It flowers in July and August, and is readily detected from its large size and the very brilliant red colour assumed by the leaves when commencing to wither. It is a less variable type than those previously noticed.

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* *Succirubra*, from the sap, which, at first colourless, becomes white and then rapidly *red* on exposure to the air (see Spruce, in 'Journ. Linn. Soc.,' iv, p. 185).

The cultivation of this species has been widely extended in our plantations; an immense number of trees are now grown in Sikkim, and Mr. Howard gives in his "Quinology" a photographic illustration of one of the Nilgiri plantations of *C. succirubra* planted in 1862. A good many varieties are found in the plantations, of which, all probability, most are hybrids; this is certainly the case with *anglica*, which resulted from crossing *C. Calisaya* with the present species.

The determination of this species as the source of Red Bark is due to Mr. Howard, who first published Pavon's MS. name in 1851, and in 1856 again gave further details; but no botanical description of the species was printed till 1858, when Klotzsch described an authentic specimen in the Berlin herbarium. His paper, quoted below, contains in the accompanying plates good figures of the microscopical characters of the bark.

Howard, Ill. Nueva Quinol., l. c.; Id., Quinol. of E. Indian Plantations, p. 87; Id., Journ. Linn. Soc., xiv, p. 170; Weddell, in Ann. Sc. Nat., ser. 5, xii, p. 64; Klotzsch, Abhand. d. k. Akad. d. Wissensch. z. Berlin., 1857, p. 51; Triana, Nouv. Études, p. 65.

Official Part and Names.—CINCHONÆ RUBRÆ CORTEX; the bark (B. P.). The bark (*Cinchonæ rubræ Cortex, Cinchona rubra*), (I. P.). CINCHONA RUBRA; the bark (U. S. P.). It is commonly termed Red Cinchona Bark, or Red Bark; and by the natives in South America it is known as *Cascarilla colorada*.

Collection, Cultivation, and Commerce.—In the British Pharmacopœia, and also in the Pharmacopœia of India, Red Cinchona Bark is said to be collected on the western slopes of Chimborazo, in the Republic of Ecuador, where, as already stated, this tree is a native. This South American Red Bark is imported in chests, and chiefly from Guayaquil, but some also comes from Lima. This tree is now largely cultivated in India, and also, to some extent, in Ceylon, Java, Jamaica, and elsewhere. The total number of trees growing in the Sikkim plantations alone has been recently estimated at 2,500,008. The collection of bark from these plants up to March, 1875, was only on a comparatively small scale,

but the crop of 1875—76 amounted to 211,931 lbs.; and it is estimated that these plantations are now capable of annually yielding 366,000 lbs. of dry red bark.

It was not unreasonably supposed that the cultivated species of Cinchona would be less productive in their yield of alkaloids than those grown in their native habitats; but experiments have now shown that their productiveness have, on the contrary, been much increased. Moreover, the very interesting and important experiments of McIvor have also proved that, under certain treatment, these trees are capable of yielding a still larger amount of alkaloids. Thus it had been frequently noticed that by direct exposure to sunlight, cinchona barks had a tendency to become red; and it was concluded that this change was due to the generation of colouring matter at the expense of the alkaloids. Hence, in order to retard or prevent this change, Mr. McIvor protected the bark from the influence of sunlight by covering the stems of the growing trees with a layer of moss; and the result of this treatment, in some cases, has been found to be so successful, as to double, triple, or even still further to increase the yield of alkaloids. Another important fact has been also ascertained, namely, that it is not necessary to adopt the wasteful process of cutting down the trees, and then removing the bark, as is done in South America, but a far more productive plan is to make the same tree yield bark in successive seasons. For this purpose longitudinal layers of the bark are removed from the top to the bottom of the trees, in the same manner as cork is obtained in the South of Europe, and carefully covering the exposed surface with moss, when it is found that the bark is renewed and equally rich in alkaloids; and thus by taking successive strips of bark in different years, the old bark becomes renewed by younger bark, and thus the tree may be continuously made to yield a supply of rich bark. Unfortunately, however, this method of mossing cannot be adopted in all districts, as for instance in Bengal, on account of the insects, chiefly ants, getting beneath the moss, and destroying the young bark as rapidly as it is formed.

General Characters.—Red cinchona bark occurs in quills, or in

CINCHONA CORDIFOLIA. *Mutis.*

Hanhart imp

N. Ord. RUBIACEÆ.
Tribe *Cinchoneæ*.
Genus Cinchona, *Linn.*

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143. Cinchona cordifolia, *Mutis, ex Humboldt in Gesellsch. Naturforsch. Freunde zu Berlin,* i, *p.* 117 (1807).

Columbian Bark.

Syn.—C. pubescens, *var.* cordata, *DC.* C. tucujensis, *Karst.*

Figures.—Hayne, vii, t. 40; Nees, t. 262; Steph. & Ch., t. 185; Woodville, v, 5; Karsten, Fl. Columb. Spec. Sel., tt. 8, 9 (*C. tucujensis*); Weddell, Hist. Nat. Quinq., t. 17.

Description.—A medium-sized tree, with a straight trunk, and a lax head of spreading branches; bark grey-brown, pale, furrowed; branchlets obtusely quadrangular, with a yellow-brown pubescence. Leaves large, spreading; petioles 1—1½ inch long, red; stipules ovate, subacute, as long as the petioles, silky on both sides with fulvous hairs, green or reddish, caducous; blade 6—8 inches or more long, very broadly oval or roundish, subacute at the apex, rounded or slightly cordate at the base, somewhat decurrent into the petiole, finely but densely pubescent on both surfaces when young, but when full grown nearly glabrous on the upper surface, veins red, no scrobicules. Flowers much as in the other species, but more crowded. Calyx strongly pubescent. Corolla about ⅝ inch long, red. Epigynous disk 5-lobed. Fruit ovate-oblong, strongly ribbed. Seeds as in the other species.

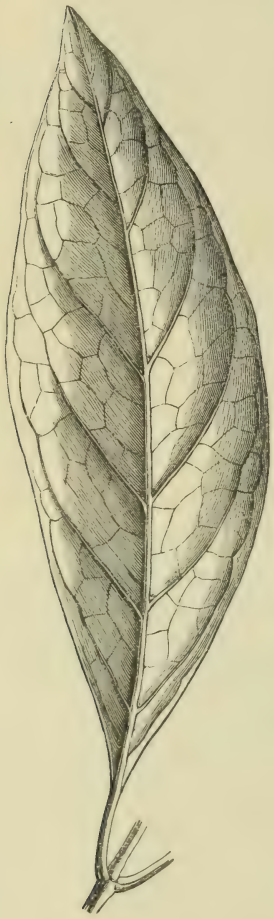
Habitat.—*C. cordifolia* has the widest geographical range of all the species of the genus, and extends in New Granada north as far as to 10° N. lat., whilst southwards it reaches Southern Peru and Bolivia.

It is especially a New Granadan form, and occurs there on the sunny margins of mountain woods at an elevation of from 4500 to over 7000 feet, its altitude as well as its horizontal distribution thus exceeding that of other Cinchonas.

As is to be expected in a plant of so wide an area, there is

much variation in form and pubescence of the leaves. These are rarely cordate except when young, the fully-grown ones having usually tapering bases; there is also much variety in the form of the capsules. Weddell's plate, above quoted, represents the var. *peruviana*, Karst.

This species is very near to *C. succirubra* in botanical characters, especially to the round-leaved form, but its yellow pubescence and the characters of the bark are a sufficient distinction.



The plant described and figured under the name *C. rosulenta*, Howard, in the Bull. Soc. Bot. France, 1870, p. 228, t. 3, which affords the Red Bark of Ocana, New Granada, is very closely allied to *C. succirubra*.

Columbian Bark is also afforded by another species, *C. lancifolia*, Mutis. As is seen from the accompanying woodcut (after Karsten) it is botanically allied to *C. officinalis* and *C. Calisaya*. Figures will be found in Hayne, vii, t. 38; Nees, t. 261; Weddell, Hist. Nat. Quinq., t. 5; and Karsten, Fl. Columb. Spec. Sel., tt. 11 and 12. A variety yielding "Soft Columbian bark," var. *oblonga*, Howard, is figured in the Bull. Bot. Soc. France, 1873, t. 2; and another affording "Santa Fé Calisaya," in Howard's Quinology, t. 14. *C. lancifolia* is a native of New Granada only, occurring between lat. 2° and 8° N., on the eastern branch of the Andean chain. It is cultivated in India and Java.

It would not be possible to go into any details as to the numerous species, varieties, and forms of Cinchona which yield the various non-official barks. The valuable works quoted at the end

of these articles—a portion only of the vast literature on the subject—will refer the reader to the source of further information.

The following figures of some of the leading species may be quoted :

C. Pahudiana, Howard, Peru ; Howard, Ill. Nuev. Quin., 21st plate.

C. micrantha, R. & P., Peru and Bolivia ; Berg and Sch., t. 14 f. ; Weddell, Hist. Nat. Quinq., tt. 14, 15 ; Howard, Ill. Nuev. Quin., 5th plate.

C. Pitayensis, Wedd., New Granada ; Karsten, Fl. Col. Sp. Sel., t. 22 (*C. Trianæ*).

C. nitida, R. & P., Peru ; Howard, Ill. Nuev. Quin., 20th plate.

Karsten, Fl. Columb. Sp. Sel., i, p. 15; Lindl., Fl. Med., p. 419; Triana, Nouv. Études, p. 66; Weddell, Hist. Nat. Quinq., p. 57; Id., in Ann. Sc. Nat., ser. v, xii, p. 70.

1. Cinchona cordifolia.—*Part Used and Names.*—Cortex Cinchonæ duræ de Carthagena ; the bark. This bark is not official in the British Pharmacopœia, or in the Pharmacopœia of India ; but it was formerly recognised in the London, Edinburgh, and Dublin Pharmacopœias, as the source of the official *yellow bark.* Neither is it mentioned by name in the Pharmacopœia of the United States, and is therefore only recognised in that volume under the general name of Cinchona, as follows :—"The bark of all species of the genus Cinchona, containing at least two per cent. of the proper cinchona alkaloids, which yields crystallizable salts." It is the Hard Carthagena Bark of Pereira and some other pharmacologists, and is also known as Columbian bark, as it and Lancifolia Bark constitute the Columbian bark of commerce. Mutis first noticed it under the name of *Quina Amarilla,* or yellow bark of Bogota ; and in Peru, it is termed *Cascarilla mula.* In English commerce the name of Carthagena is applied generally to the barks of *Cinchona cordifolia* and *C. lancifolia.* The bark of other species of Cinchona are, however, also imported from Carthagena.

Commerce.—It is chiefly derived from New Granada, but some-

orange or *yellow*, to which the name of *Coquetta bark* is properly restricted; the other *red*, and known in commerce as *red Carthagena bark*.

In percentage of alkaloids these Carthagena barks are liable to great variation, as also in the nature of the alkaloids they contain. Generally speaking, Coquetta bark is most rich in quinia; and red Carthagena bark in cinchonidia. Cinchonia also occurs in both varieties, but in very variable proportions.

Medical Properties and Uses.—Its properties and uses are similar to those of other Cinchona barks, and are described together with those of their alkaloids under "Cinchona Calisaya." It is, however, very inferior to Calisaya Bark.

Per. Mat. Med., vol. ii, pt. 2, p. 110; Per. Mat. Med, by B. & R., p. 729; Pharmacographia, p. 316; U. S. Disp., by W. & B., p. 288; Howard, in Pharm. Journ., vol. xi, ser. 1, p. 558.

DESCRIPTION OF PLATE.

Drawn from a specimen collected by Pavon, in the British Museum (the sections of the ovary after Karsten).

1. A branch with flower-panicle.
2. Vertical, and—3. Transverse section of ovary.
4. Capsule.
5, 6. Seeds.
7. A lower leaf.

(2, 3, 6 enlarged.)

COFFEA ARABICA, *Linn*

N. Ord. Rubiaceæ.

Tribe *Ixoreæ*.

Genus Coffea,* *Linn.* B. & H., Gen., ii, p. 114. Species about 25, natives of the tropical parts of the Old World.

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144. Coffea arabica, *Linn., Sp. Plant., ed.* 1, *p.* 172 (1753).

Coffee. Bonn, Boun (Abyssinia).

Figures.—Woodville, t. 70; Steph. & Ch., t. 182; Tussac, Fl. Antilles, i, t. 18, cop. in Hayne, ix, t. 32; Nees, t. 257; Mém. de l'Acad. Royale d. Sciences, Paris, 1716, p. 298; Bot. Mag., t. 1303.

Description.—A small tree, 10—15 feet high, or a large shrub, with spreading roots, a thick trunk and long, horizontal, arching, opposite branches; branches straight, cylindrical but laterally compressed and dilated at the nodes, bark smooth, pale grey or yellowish, young twigs glabrous. Leaves opposite, persistent but scarcely evergreen, spreading, petioles about ½ inch long, flat above; stipules about ¼ inch long, intrapetiolar but united at the base, broadly triangular, ovate attenuate, entire, glabrous, persistent, blade about 4—6 inches long, oval, attenuate at the apex, wedge-shaped at the base, entire, somewhat undulated at the margin, rather thick, quite glabrous, glossy, dark green, veins prominent beneath. Flowers of moderate size, very shortly stalked or nearly sessile, arranged in small, very shortly stalked cymes of three, one to three of which are crowded in the leaf-axils, bracts very short, rigid, connate at the base of the pedicels. Calyx small, the tube united with the ovary, the limb very short, truncate, faintly 5-toothed, smooth, persistent. Corolla with a somewhat funnel-shaped tube about ¼ inch long, and 5 oblong-oval, sub-acute, spreading segments ⅜ inch or more in length, dextrorsely convolute in the bud, white, glabrous, easily falling. Stamens 5, inserted in the mouth of the corolla-tube, filaments short, flat,

* *Coffea*, formed by Linnæus from Coffe, or Coffee, the name of the berries throughout Europe so early as the middle of the 17th century, and an alteration of the Arabic name for the decoction, variously spelt chaubé, cavé, cahua, caova.

anthers narrowly linear, $\frac{3}{8}$ inch long, versatile, 2-celled, somewhat twisted, cream-coloured. Ovary inferior, smooth, 2-celled, with a single ovule in each cell, surrounded at the base by a prominent, rounded, epigynous disk; style slender, the length of the corolla-tube, stigmas two, linear, spreading, flat. Fruit oblong-ovoid, very blunt and rounded at both ends, $\frac{1}{2}$—$\frac{2}{3}$ inch long, marked at the summit with the scar of the fallen flower and calyx-limb, smooth, circular on transverse section, scarlet becoming purple when fully ripe; pericarp with a scanty, scarcely succulent pulp, and a thin dry endocarp, 2-celled, the flat dissepiment ultimately splitting along its median plane, and the endocarp thus forming a chartaceous envelope to each of the seeds. Seeds large, solitary in each cell, attached above the centre, oval, rounded on the back, flat on the ventral surface, which is marked down the centre with a deep narrow fissure; testa very thin and membranous, loose; endosperm forming the bulk of the seed, convoluted, the testa extending into the convolutions, hard, horny, pale yellowish-grey; embryo very small, embedded in the base of the dorsal convolution, cotyledons small, cordate, acute, radicle inferior, blunt, longer than the cotyledons.

Habitat.—Coffee is a native of tropical parts of Africa, on both the eastern and western sides of the continent, and also in the elevated interior. It is common in Abyssinia, abundant in Angola, and has been met with near Lake Nyanza; in all places indubitably wild. It is also said to be indigenous on the Mozambique coast. The tree grows gregariously in woods, in hilly country, at 1000—2000 feet or more elevation.

It was as a product of Arabia that coffee was first known to Europeans; the plant is not, however, considered a native of that country, and is stated to have been introduced so late as the 15th century from the opposite coast of Abyssinia, where the properties of the berries had been known from time immemorial. Coffee, as a beverage, became known at Constantinople in 1554, but did not reach Western Europe till a century later, being first drunk in London in 1652. By this period the plant itself had become known to botanists, Prospero Alpino having, in 1592, given a

description and a rough figure of a cultivated specimen he saw in a garden in Egypt. The Dutch were the first European people to grow the plant at the end of the 17th century at Batavia from Arabian seeds. In 1690 one of these was sent to Witsen at Amsterdam, and the plant soon became known in European gardens. Bishop Compton had it at Fulham in 1696, and in 1716 Jussieu gave for the first time a full botanical description and good figure from plants sent to Paris from Holland. The Dutch also imported the plant into the New World, the first coffee being grown at Surinam in 1718, whence in 1725 it was secretly carried to Cayenne by the French. Its introduction into the West Indies appears to be due to a French naval officer, who in 1720 or 1723 brought the plant to Martinique.

At the present time coffee is cultivated in nearly all tropical and subtropical countries, where in suitable localities it readily becomes semi-naturalized. Ceylon is the great source of the coffee consumed in England. In the hilly district of the tropical portion of Arabia, especially about Mocha, the tree has been extensively grown for several centuries, and now occurs spontaneously. This variety is characterised by a more erect habit, with smaller foliage, and smaller, often somewhat ovate, fruit; it is that represented in Jussieu's original figure. There are many other varieties of coffee depending on the size, form, and colour of the berries.

Examples of *C. arabica* may be seen in the stoves of most botanic gardens, where flowers and fruit are somewhat rarely produced and at irregular periods. The flowers are sweet scented, and vary considerably in size and in the width of the corolla-segments.

The berries of some other species are used; *C. mauritiana*, Lam., of Bourbon and Mauritus, *C. zanguebariæ*, Lour., of Mozambique, and especially *C. liberica* Hiern, from the West Coast of Africa. This last species bids fair to become a very important source of coffee, and to supplant *C. arabica* in many tropical countries. It is a larger and more robust plant, and flourishes at a lower elevation; the berries are consider-

ably larger and of a finer flavour. It is this species which affords the Liberian or Monrovian coffee; it was long since recognised as a distinct species, but did not receive a proper scientific description and name till 1877, when Mr. Hiern published it in the Linnean Transactions with a good figure (Trans. Linn. Soc., ser. 2, i, t. 24).

Prosper Alpinus, De Plant. *Ægypti* (1592), p. 26; Parkinson, Theatr. Bot. (1640), p. 1622; Ray, Hist. Plant. (1688), p. 1691; Plukenet, Phytographia, t. 272, fig. 1 (1696); Jussieu, in Mem. Acad. Roy. Paris, 1713 (1716), p. 291; Ellis, Historical Account of Coffee (1744); DC. Géographie Bot., p. 969; Grant, in Trans. Linn. Soc. Lond., xxix, p. 87; Hiern, ibid., ser. 2, i, p. 170, and in Fl. Trop. Africa, iii, p. 180; Lindl., Fl. Med., p. 440.

Official Part and Name.—CAFFEA; the seed (U. S. P.). It is not official in the British Pharmacopœia, or the Pharmacopœia of India.

Preparation, General Characters, and Varieties.—Each fruit contains two seeds, which are enclosed in a parchment-like or papery endocarp, from which they are separated by drying, and by the action of peeling and winnowing mills. In commerce coffee is found in two states, *raw* and *roasted*. *Raw coffee* consists of the seeds, which are erroneously termed coffee berries, deprived of their endocarp, and also to some extent of their testa; and *roasted coffee* consists of the same seeds which have been submitted to the process of roasting. In the process of roasting the testa separates from the seed, and is commonly termed by the roasters "flights" or "the fibre;" the remaining portion, the bulk of which is formed of endosperm or albumen, is that which is used in the preparation of the unfermented beverage termed coffee.

Several varieties of coffee are known in commerce; these are commonly distinguished from their geographical sources, as Mocha or Arabian, Java, Ceylon, Malabar or East Indian, Jamaica, Brazilian, Liberian, and many others. Liberian coffee, which is a very fine variety, is, however, as already noticed, not derived from *Coffea arabica*, but from *C. liberica*. These varieties vary considerably in their characters, thus in colour, in a raw

state, they are yellow, blueish, or greenish; and in size they vary from about three to five lines in length, and from two to three lines and a half in breadth. In form they are all convex on one side, and flattish, with a longitudinal groove, on the other. Mocha coffee is small and dark yellow; Java and East Indian kinds are larger and paler yellow; while Ceylon, Brazilian, and West Indian kinds, such as Jamaica and Demerara, have a blueish or greenish-grey tint. Mocha coffee is regarded as the finest of all the kinds. All varieties improve by age, in consequence of losing a portion of their strength and coarseness, and acquiring a more agreeable flavour. Good coffee is hard and readily sinks in water; it is regarded as inferior when soft, light, dark-coloured, or musty. In a raw state it is almost tasteless and inodorous; but when roasted it acquires a fragrant odour and decidedly bitter taste. The excellence of the flavour of coffee depends to a very great extent upon the manner in which it is roasted and the length of time in which it is exposed to the process. The roasting should be conducted in a properly constructed vessel at a moderate temperature, that is, not exceeding from 435° to 440°; and when the seeds have become of a chestnut-brown colour the process should cease, or otherwise the coffee becomes bitter and acrid, and loses more or less of its flavour, according to the time the roasting process is prolonged. The coffee should not be roasted long before being used, and should not be long kept in a ground state. On the Continent coffee is roasted in private houses, and also by the grocers, daily, in small quantities. In this country we roast coffee in bulk, and the larger the roast the greater the difficulty of obtaining a good product. This explains in a great degree the inferiority of our coffee as a beverage to that prepared in parts of the Continent, more particularly Austria, where probably the best coffee may be obtained.

Composition.—The principal constituents of raw coffee are *caffein*, *caffeo-tannic acid*, a peculiar kind of *sugar*, and about 13 per cent. of *gluten*. Caffein is identical with thein, which has already been noticed in our description of "Camellia Thea" and "Paullinia sorbilis," where it is also said to be contained in five different substances, namely tea, coffee, guarana, Paraguay tea,

and Kola-nuts. The proportion of caffein in coffee may be stated at from 0·75 to 1 per cent. Caffein crystallises in opaque, silky, flexible needles, or in long transparent prisms; it has a feebly bitter and disagreeable taste; is soluble in water, alcohol, and ether; is a highly nitrogenised body, with feeble basic properties; and when exposed to heat it melts, and at a higher temperature sublimes without residue. Caffein is thought to exist in coffee partly in a free state, and partly combined with a peculiar acid. *Caffeo-tannic acid* is said by Klasiwetz to be a glucoside, as it is resolvable into glucose, and a peculiar crystallizable acid, termed by him caffeic acid.

The changes produced in coffee by roasting require further investigation; but, as already noticed, it acquires by this process a fragrant odour, and a decidedly bitter taste. It also swells during the process to nearly twice its original volume, while it loses from 15 to 20 per cent. of its weight. A *brown bitter principle,* and a *volatile oil* called *caffeone,* are also said to be developed during the process. Caffein itself does not appear to undergo any change, as it may be extracted in an unaltered state from roasted coffee. The effects of roasted coffee would appear to be due to the combined influence of caffein, caffeo-tannic acid, the bitter principle, and volatile oil.

Adulterations.—When sold in a ground state it is frequently largely adulterated, the most common adulteration being roasted chicory powder, the readiest mode of detecting which is given by Pereira as follows:—Place a portion of the suspected coffee gently on the surface of cold water in a glass. If it be genuine it becomes very slowly moistened by the water, even when we stir them up together, and in consequence floats on the surface, and communicates scarcely any colour to the liquid. This arises from the coffee being impregnated with volatile oil, which exercises a repulsive influence on the water. Chicory, on the other hand, readily absorbs and mixes with the water, to which it speedily communicates a deep reddish-brown tint, and sinks to the bottom of the liquid. Roasted corn and roasted pulse (peas, beans, and lupins) behave, in relation to water, like roasted chicory.

Medical Properties and Uses.—The effects and uses of coffee closely resemble those of tea. When roasted its effects are thus described by Wood :—"In moderate quantities, coffee stimulates the stomach gently, and the nervous system decidedly, without much exciting the circulation, or producing any narcotic impression on the brain. These are the properties which characterise the nervous stimulants, and to this class, therefore, it properly belongs. It will be found to belong to it equally by its therapeutic effects. Upon those who use it habitually, its characteristic influence is not fully evinced, as it has either lost its power in a great measure by repetition, or the secondary are so mingled with the primary effects, that the latter are not readily distinguishable." The astringent action of coffee is much less than that of tea, and hence it use does not cause constipation to the same effect as it. Moreover, the volatile oil of coffee is said to have an aperient tendency. Wood thus gives the effects of tea as compared with those of coffee :—"Tea differs in its effects from coffee mainly in degree. It is less stimulant to the nervous system, less apt to oppress the stomach, probably quite as efficient as a tonic to the digestive organs, and more astringent in consequence of the amount of tannic acid it contains. Certain it is that tea, especially black tea, may be taken habitually with impunity by persons who cannot use coffee without suffering, and that it sits more lightly on the stomach. In febrile diseases, a cup of tea is often not only tolerated, but agreeable to the patient, and refreshing in its effects; while coffee, however much it may be relished in health, is usually repulsive to the patient in a fever, and not well accepted by the stomach or the system." Medicinally coffee has been used in nervous and sick headaches, in narcotic poisoning, in spasmodic asthma, hooping-cough, nervous dyspnœa and palpitation of the heart, in intermittent fever, and many other complaints, and frequently with most beneficial results. It can scarcely be doubted that both tea and coffee would have been much more employed therapeutically had their habitual use as articles of diet not limited their application.

The principal use of coffee is, however, like that of tea, to form

an agreeable, stimulating, soothing, and refreshing beverage; and like it it is frequently resorted to by those who desire to produce wakefulness during the night for the purpose of study, &c. Its immoderate use is said to produce nervous symptoms, such as anxiety, tremor, disordered vision, palpitation, and feverishness.

The annual consumption of coffee in all parts of the world may be roughly estimated at about 1200 millions of pounds; it is, however, a remarkable fact that, while the consumption of tea in this country has steadily increased since 1840, as noticed in our description of tea, that of coffee has fallen from about 24 ounces per head in 1840 to less than 16 ounces at the present time, or a total consumption of about 35 millions of pounds annually. The annual consumption in the United States is about 6 lbs. per head; and in Holland it is as high as 10 lbs.

Coffee Leaves.—Besides the seeds of the coffee plants, the roasted leaves are used as a beverage in the Island of Sumatra, and have analogous properties to those of ordinary coffee. Examined by Stenhouse, they were found to contain both caffein and caffeo-tannic acid, but in larger proportions than in the roasted seeds. An infusion of the leaves in boiling water has a deep brown colour, and in taste and odour somewhat resembles a mixture of tea and coffee. It is, however, by no means so agreeable a beverage, as coffee or tea; and moreover, from the fact that both seeds and leaves cannot be commercially obtained from the same plant at the same time, the latter are not likely ever to come into much demand as a substitute for either tea or coffee.

Per. Mat. Med., vol. ii, pt. 2, p. 67; Watts, Dict. Chem., vol. i, pp. 1069—1075; Hassall, Adulterations Detected, p. 105; Johnston, Chem. of Common Life, vol. i, p. 200; Wood, Therapeutics and Pharmacology, vol. i, p. 625; U. S. Disp., by W. & B., p. 185; Waring, Man. Prac. Therap., p. 248; Lancet, Jan. 6th, 1851, p. 22; Branson, in Journ. Soc. of Arts, vol. xxii, April 10th, 1874, p. 456; Pharm. Journ., vol. xii, ser. 1, p. 443, and vol. xiii, pp. 207 & 382.

DESCRIPTION OF PLATE.

The flowering specimen drawn from one collected by Schimper in Abyssinia; the fruit from Martinique, collected by Hahn; both in the British Museum.

1. A branch with flowers and young fruit.
2. A flower.
3. Section of the same.
4. The ovary.
5. Transverse section of the same.
6. A cluster of fruit.
7. A single berry.
8. Transverse section of the same.
9. A seed seen on its ventral surface.
10. The same, dorsal surface, a portion of the base cut away to show the embryo.
11. Vertical section of the same.

(3–5 enlarged.)

P.Blanchard nat. del. et lith.

M&N Hanhart imp.

CEPHAELIS IPECACUANHA, *Rich.*

N. Ord. RUBIACEÆ.

Tribe *Psychotrieæ*.

Genus Cephaelis,* *Swartz.* B. & H., ii, p. 127. Species about 70, all tropical, and chiefly American, but a few in the old world.

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145. Cephaelis Ipecacuanha,† *A. Rich., Hist. Nat. Ipec., p.* 21 (1820).

Ipecacuanha. *Poaya* (Brazil).

Syn.—C. emetica, *Pers.* Callicocca Ipecacuanha, *Brot.* Ipecacuanha officinalis, *Arruda.*

Figures.—Woodville, t. 274 and vol. 5; Hayne, viii, t. 20; Martius, Mat. Med. Brasil, tt. 1 and 8, cop. in Nees, t. 258; Trans. Linn. Soc. Lond., vi, t. 11, cop. in Steph. & Ch., t. 62; Berg and Sch., t. 15 c; Bot. Mag., t. 4063; St. Hil., Pl. Usuelles des Brasil, t. 6; Trans. Roy Soc., Edinb., xxvi, tt. 31, 32.

Description.—A half-shrubby perennial, roots several, spreading horizontally from their origin, at first slender and white, when fully grown about $\frac{1}{5}$ inch in diameter, long, scarcely branched, orange-brown, irregularly bent and twisted, covered with a very thick bark which is deeply and closely furrowed transversely along the whole length so as to form narrow rings. Stem more or less rhizomatous and rooting, or decumbent, or erect, not more than 18 inches long, woody, rounded, knotted and marked with leaf scars, smooth and grey at the base, quadrangular, pubescent, and green above, simple or slightly branched. Leaves few, somewhat crowded at the upper part of the stem, opposite, shortly stalked, stipules large, united at the base, where are several ovoid glands, persistent, adpressed to the stem, whitish, about as long as the petiole, deeply cut into four subulate laciniæ, blade 2—4 inches long or more, oval, acute or blunt at the apex, entire and more or

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* *Cephaelis*, from κεφαλή, a head, and ἐιλω, to collect, from the flowers being collected into a capitulum.

† *Ipecacuanha*, one of the Indian names for the plant, but applied also to several other plants, *e. g.* species of *Ionidium.*

less wavy on the margin, thick, with a few hairs on the edge, dark green and nearly smooth above, paler, somewhat pubescent and with prominent veins beneath. Flowers small, sessile, about 10—20 together, in a dense head supported on a cylindrical, pubescent, purplish, axillary but apparently terminal peduncle, at first erect, afterwards bent downwards, and surrounded by an involucre of four ovate, entire, downy, unequal bracts; a small acute pubescent bract accompanies each flower.[4] Calyx adherent, downy, the limb free, of 5 short, triangular-ovate, acute, irregularly toothed segments. Corolla funnel-shaped, hairy outside, white, tube much longer than the calyx-segments, slightly hairy within, limb shallowly cut into 5 ovate, pointed, spreading or somewhat reflexed lobes. Stamens 5, inserted at about the middle of the tube, filaments either very short so that the anthers are included in the tube of the corolla, or elongated so as to bring them up to its mouth, anthers 2-celled, linear-oblong. Ovary inferior, with a fleshy epigynous disk on the top, 2-celled, with a single erect ovule in each cell, style either short (to about the middle of the corolla tube) or long (exserted considerably beyond its mouth), stigma 2-lobed, papillose. Fruit several in a small cluster at the end of the reflexed peduncle, fleshy, smooth, shining, deep purple-violet, about ½ inch long or a little more, broadly ovoid, somewhat tapering or flattened at the top, where it is marked by the scars of the calyx-lobes, pulp whitish, pasty, enclosing 2 hard, stony pyrenes, convex on the outer surface, flattened on the inner, which is grooved from top to bottom. Seed solitary in each pyrene, and similar to it in form, testa membranous, embryo small, straight, at the base of the abundant horny endosperm.

Habitat.—This grows in abundance under the shade of trees in the hot moist forests of many parts of the vast empire of Brazil, occurring in clumps of numerous plants together. It has also been found in New Granada and probably in Bolivia. It was cultivated in this country at Edinburgh before 1832, and flowered at Glasgow in 1843.

The Ipecacuanha is a somwhat variable plant, differing in general habit, in the form and texture of the leaves, and the amount of

hairiness; its flowers are distinctly dimorphic, and for the abundant production of fruit it is necessary that a long-styled pistil be fertilised by pollen from the long stamens which occur in the flowers where the pistil has a short style; fertilisation has thus been artificially effected and ripe fruit produced at Edinburgh.

A remarkable point is the great facility with which even a very small portion of the singular annulated root is capable of producing adventitious buds. This fact was first observed in 1869 by Mr. McNab, Curator of the Edinburgh Botanical Gardens, and has proved of great utility by enabling a large number of young plants to be sent to India, where, in the Rungbi Valley, Sikkim, 3000 feet above the sea, a very extensive system of cultivation has been established. Even the leaf-petioles, if placed in suitable soil, are capable of producing buds and rootlets, and the plant has been propagated by this means also.

Aublet's genera *Tapogomea* and *Carapichea* are of older date than Richard's *Cephaëlis* (1775 against 1788), in which, however, they are now both included. Linnæus' *Ourayoga* is still older (1737), as from an examination of his imperfect specimen in the British Museum this is a *Cephaëlis* and probably the present species (see Linn. Hort. Cliffort., p. 486).

DC., Prod., iv, 535; Brotero, in Trans. Linn. Soc., vi (1802), p. 137; Lindl., Fl. Med., p. 442; Journ. Bot., 1872, p. 377; Balfour, in Trans. Roy. Soc. Edinb., xxvi (1872), p. 781, & Trans. Bot. Soc. Edinb., 1872, p. 151; Flück. & Hanb., Pharmacogr., p. 331.

Official Part and Names.—IPECACUANHA; the dried root (B. P.). The root (*Ipecacuanhæ Radix*) (I. P.). IPECACUANHA; the root (U. S. P.).

Collection, Preparation, and Commerce.—The roots of the Ipecacuanha plant are collected more or less all the year round, but less during the rainy season from the difficulty then experienced in drying them properly. The collectors are called *Poayeros* from the Brazilian name *Poaya* by which this plant is known. A Poayero collects the roots by grasping in one hand as many stems as he is able, and with the other he pushes a pointed stick obliquely with

a see-saw motion into the ground beneath the plants, by which he is able to pull up a lump of earth with the inclosed roots in an almost unbroken state. The earth is then shaken from the roots, which are placed in a bag brought for that purpose, and the same process is repeated with other plants. When the Poayero pulls up the roots, he breaks them at certain points, and from these broken parts of the roots which are left in the soil, young plants are subsequently produced, and thus the total destruction of the plant is prevented. In the evening the Poayeros put their collections together, and the roots are then spread out and dried as rapidly as possible by exposure to sunshine during the day, but they are protected from the heavy dew at night. After being perfectly dried, which process generally takes two or three days, the roots are broken up into pieces a few inches in length; these are then shaken in a sieve to separate any remaining adherent earth; and finally packed in bales for exportation. The annual imports of ipecacuanha into the United Kingdom may be estimated at about 65,000 lbs., representing a money value of nearly £15,000. It is principally imported into this country from Brazil; but also to some extent from Carthagena.

General Characters and Composition.—Ipecacuanha or Ipecacuan is in more or less twisted, simple or branched pieces, usually from about two to four inches long, and ordinarily the size of a small writing quill, but smaller pieces may be frequently found. It consists of a slender central woody axis or meditullium of a whitish colour; and a thick investing cortical portion, which has a brownish, reddish-brown, greyish-brown, or grey colour externally; and is marked with irregular circular fissures, which sometimes extend to the woody axis, and thus give the roots the appearance of a number of rings strung upon a cord, and hence the name annulated ipecacuanha which is applied to this root and by which it is distinguished from the non-official ipecacuanhas. The cortical portion constitutes from 75 to 80 per cent. of the entire root; it has a resinous or somewhat waxy fracture, and presents a semi-transparent horny appearance. The cortical portion is by far the more active portion of the root; the woody axis being almost inert. Mixed

with the roots or attached to them are frequently found portions of the non-annulated, slender, subterranean stems; but these are very inferior to the roots. Ipecacuanha has a somewhat acrid and bitter taste; and when powdered a faint peculiar odour, which is peculiarly disagreeable to some persons, producing violent sneezing, cough, and a species of asthma. The powder has a pale brown colour.

The above characters apply more particularly to the drug as derived from Brazil, but of late years another variety of Ipecacuanha which is imported from Carthagena, and which is distinguished as *Carthagena* or *New Granada Ipecacuanha*, is sometimes to be found in the London market, and also in New York. It is distinguished by its larger size, less annulated character, and the distinctly radiated appearance of its woody axis or meditullium.

Ipecacuanha owes its properties essentially to a peculiar alkaloid called *emetia* or *emetine* which exists in the root in the proportion of about 1 per cent.; it is, however, principally contained in the cortical portion, the wood only exhibiting traces of its presence, hence the former, as already noticed, is the most active part of ipecacuanha. The other peculiar principles are *ipecacuanhic* or *cephaëlic acid*, and a trace of a *fœtid volatile oil*. A large amount of *starch* is also present in the root, and some other unimportant substances. *Emetia* is an amorphous, colourless, inodorous alkaloid, with a bitter taste. It is readily soluble in chloroform or alcohol, and also in acetic and other acids; but is only sparingly soluble in water, ether, and oils. *Ipecacuanhic acid* is a glucoside; it is a reddish-brown, amorphous, very deliquescent bitter substance, and is closely allied to kinic and caffetannic acids.

Adulterations and Substitutions.—Ipecacuanha is not, so far as we know, liable to be adulterated by admixture with other roots; but the greater proportion of the root which reaches the London market is more or less damaged by sea water or damp, and some samples also contain a very large quantity of the inferior, nearly smooth, non-annulated, woody stems. In a powdered state it has been adulterated with almond meal, which is readily detected by the development of hydrocyanic acid upon infusion in water.

Other emetic roots are also known in Brazil under the same name *Poaya* as that of the true ipecacuanha, and some of these spurious ipecacuanhas, as well as those of other countries, are occasionally forwarded to Europe and the United States. The kinds usually met with are the *Large Striated* or *Black Ipecacuanha,* from *Psychotria emetica* (Rubiaceæ), a native of New Granada ; *Small Striated Ipecacuanha,* which, according to Planchon, is probably derived from a species of *Richardsonia ;* and *Undulated Ipecacuanha,* from *Richardsonia scabra* (Rubiaceæ). All these are very inferior in their properties to the official Ipecacuanha, and may be readily distinguished from it by their non-annulated appearance and other well-marked characters.

Medical Properties and Uses.—In large medicinal doses ipecacuanha is emetic; in small doses expectorant and diaphoretic; and in intermediate doses nauseant. Locally applied to the skin it acts as a counter-irritant. From its stimulant action on the alimentary canal it has always been in repute as a remedy in chronic dysentery and diarrhœa; and in large doses of 30 grains and upwards it is regarded in India as almost a specific in acute dysentery. In very small doses it has been recommended by Dr. Ringer, in the vomiting of pregnancy; small doses are also often useful in atonic dyspepsia. As an expectorant it is in frequent use in catarrhs, chronic bronchitis, whooping-cough, and other pulmonary affections. As a diaphoretic it is generally combined with opium, which is generally supposed to increase its action, hence in the form of Dover's powder it is commonly employed in catarrhal, rheumatic, and neuralgic affections, and in other cases. On account of the sedative effect on the vascular system which follows its use as a nauseant, it is frequently serviceable in hæmorrhages, more especially in that from the uterus. As an emetic ipecacuanha acts with certainty and safety, and without depressing the system so much as tartar emetic. It is well adapted for children and delicate persons when our object is to remove crude and indigestible matters from the stomach. In febrile chest affections, as bronchitis, phthisis, and croup, it is especially valuable as an emetic. It does not act so speedily as sulphate of zinc or

even mustard; hence these substances are better adapted as emetics for evacuating the contents of the stomach in cases of poisoning.

Emetia has sometimes been employed, more especially on the Continent of Europe, as a substitute for ipecacuanha; but it presents no advantages over the crude drug, and its use might be followed by serious and even fatal consequences.

Per. Mat. Med., by B. & R., p. 703; Pharmacographia, p. 331; U. S. Disp., by W. & B., p. 494; Pharmacopœia of India, p. 115; Garr., Mat. Med., p. 285; Royle's Mat. Med., by J. Harley, p. 549; Gmelin's Chemistry, vol. xv (1862), p. 523; Balfour in Pharm. Journ., vol. ii, 3 ser., pp. 948 and 969; Pharm. Journ., 3 ser., vol. iv, p. 569; Amer. Journ. Pharm. vol. xxiii, p. 352, and vol. xxv, p. 474; Attfield, in Proc. Brit. Pharm. Conf. (1869), pp. 37—39; Pharm. Journ., 1 ser., vol. x, p. 608; Planchon, in Journ. de Pharm., vol. xvi, p. 404, and vol. xvii, p. 19; Duckworth, in St. Bartholomew's Hosp. Reports, vols. v and vii.

DESCRIPTION OF PLATE.

Drawn from a plant in the Royal Gardens, Kew, flowering in April; the fruit copied from Balfour.

1. Upper part of the plant.
2. Lower part and root.
3. Corolla laid open.
4. Section of ovary.
5. Ovary, calyx, and disk.
6. Cluster of fruit (from the short-styled plant).
7. Transverse section of a fruit.
8. A pyrene, ventral surface.
9. A seed.

(3—9 enlarged.)

M & N. Hanhart imp

VALERIANA OFFICINALIS. *Linn.*

N. Ord. VALERIANACEÆ. Lindl., Veg. K., p. 697; Le Maout and Dec., p. 488.

Genus Valeriana,* *Linn.* B. & H., Gen., ii, p. 155. Species 150, natives of temperate climates in both old and new worlds, principally of the northern hemisphere.

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146. Valeriana officinalis, *Linn., Sp. Plant., ed.* 1, *p.* 31 (1753).

Common Valerian. All-heal.

Syn.—V. sambucifolia, *Mikan.* V. angustifolia, *Tausch.*

Figures.—Woodville, t. 32; Hayne, iii, t. 32; Steph. & Ch., t. 54; Nees, t. 254; Berg & Sch., t. 28 d; Curt., Fl. Londin., fasc. 6; Syme, E. Bot., iv, t. 666; Reichenb., Ic. Fl. Germ., xii, tt. 726, 727 Nees, Genera Fl. Germ.

Description.—A perennial herb with a very short upright root-stock giving off numerous, slender, rather fleshy, cylindrical, tapering, pale-brown roots, 3 or 4 inches long, and also often sending out short runners or suckers, at the ends of which young plants are developed. Stem solitary, erect, 2—3 feet high, branched only at the top, cylindrical, hollow, fluted and channelled, smooth, often a little hairy at the base and just beneath the nodes. Leaves few, opposite, pinnate, the lower ones (soon withering) with long petioles dilated and stem-clasping below, leaflets sessile, opposite or alternate, 8—20 with a terminal one, $\frac{3}{4}$—$2\frac{1}{2}$ inches long, varying from oval to linear-lanceolate, acute, entire or serrate on the inner or on both margins, smooth, thin, shining, the upper leaves sessile, very much smaller, scarcely compound and passing into bracts above. Flowers small, numerous and crowded, sessile, arranged in threes at the extremities of the ultimate divisions of the trichotomous, compound, divaricate cymes which terminate the stem and branches, the whole forming a large more or less flat-topped cyme; bracts numerous, entire, linear-acuminate, membranous.

* *Valeriana*, a name first met with in use by the pharmacists and physicians of the 9th or 10th centuries; of uncertain meaning and origin, but probably from *valeo*, to be powerful, from its effects as a drug.

Calyx-tube combined with the ovary, the limb small and ring-like, lobed, the lobes curled inwards. Corolla about $\frac{1}{6}$ inch wide, pale pink, with a narrowly funnel-shaped tube, gibbous at the base below, and 5 nearly equal, spreading, broadly oblong, rounded lobes, the odd one inferior, the tube hairy within. Stamens 3, inserted about half way down the tube of the corolla and alternating with its lobes (the posterior and one of the anterior ones being suppressed), much exserted, anthers small, two-celled, yellow. Ovary inferior laterally compressed, smooth, one-celled (2 suppressed) with a single pendulous anatropous ovule, style a little longer than the corolla-tube, stigma 3-fid. Fruit scarcely $\frac{1}{6}$ inch long, ovate-oblong in form, plane-convex, compressed, with 3 prominent ribs on the convex, and 1 on the plane side, pale brown, smooth, indehiscent, crowned with the persistent calyx-lobes which have developed into elegant curved feathery plumes (pappus). Seed solitary, filling the fruit-cavity, straight, with large flat obovate cotyledons; no endosperm.

Habitat.—Valerian is a common plant in all parts of this country, growing in damp ground, both in woods and open places. It has a very extensive distribution from Iceland, Arctic Europe and Asia to the Mediterranean, Crimea, West Asia and Japan, and several forms are distinguished. The plant with fewer and wider leaflets (*V. sambucifolia*, Mikan) is by far the most common in England, and is partial to more wet places than the form figured, var. *Mikanii*, Syme, which is found more rarely, in upland pastures, especially chalky banks and similar places.

Valerian is cultivated for use near Chesterfield in Derbyshire, also in Holland, and near New York, and some other parts of the United States.

Syme, E. Bot., iv, p. 236; Hook. f., Stud. Fl., p. 181; Watson, Comp. Cyb. Brit., p. 205; Gren. & Godr., Fl. France, ii, p. 54; Ledebour, Fl. Ross, ii, p. 438; Franchet & Savatier, Enum. Plant. Japon., i, p. 217.

Official Part and Names.—Valerianæ Radix; the dried root, from plants indigenous to, and also cultivated in, Britain; col-

lected in autumn, that from wild plants growing on dry soil to be preferred (B. P.). The root (*Valerianæ Radix*) (I. P.). VALERIANA; the root (U. S. P.).

Collection.—In England valerian is chiefly collected in the autumn from cultivated plants; but some is also obtained from wild plants. When cultivated, the tops are cut off in the spring so as to prevent the plants from flowering and seeding, which materially injures their activity; and at Michaelmas, the rhizomes or roots are dug up carefully and washed; the remaining tops are then cut close off, and the thickest part of the rhizomes slit down to facilitate their drying, which is effected in a kiln; they are then packed tight, and kept very dry, to prevent their spoiling.

General Characters and Composition.—The so-called valerian root consists of a very short, upright, tuberculated rhizome, about the thickness of the little finger, from which arise numerous slender tapering rootlets, three or four inches long. These rootlets have a shrivelled appearance, are very brittle, and like the rhizome, have a dark yellowish-brown colour externally, and are whitish within.

Valerian root has a camphoraceous, slightly bitter, unpleasant taste; and a strong, peculiar, somewhat camphoraceous and terebinthinate odour, which to most persons is very disagreeable. This very characteristic odour is acquired by valerian root as it dries, for when in a fresh state, the odour is scarcely noticeable. The cultivated valerian root is less active than the uncultivated or wild sort, although from being the finer-looking it is commonly preferred by pharmacists.

When distilled with water valerian root yields a *volatile oil* and *valerianic acid*, to which substances, more especially the former, it owes its activity. The volatile oil is contained in the dry commercial root in varying proportions of from ½ to 2 per cent., the root collected from plants found in a dry stony soil yielding more oil than when derived from those growing in a wet fertile one. When the oil is first distilled it has but very little odour, but by exposure to the air it acquires the strong characteristic odour of valerian root. Oil of

valerian as obtained from the dried root is a mixture of about 5 per cent. of *valerianic acid*, 25 per cent. of *valerene* or *borneene*, which very much resembles oil of turpentine, and the remainder consists of various oxygenated compounds. A difference of opinion exists amongst chemists as to whether the volatile oil exists ready formed in the living root, or whether it is produced by a reaction similar to that which takes place in the production of the volatile oil of bitter almonds. It is certain, however, that valerianic acid and the various resinoid products contained in the oil are the results of oxidation.

Medical Properties and Uses.—Valerian is a stimulant, antispasmodic, and nervine tonic, but as an antispasmodic it is much inferior to assafœtida. In excessive doses it causes headache, mental excitement, and various other effects indicating derangements of the nervous system. Large doses also frequently cause nausea. It has been used with much advantage in hysteria and in hysterical affections generally. It has also been much employed in epilepsy, chorea, and hypochondriasis, but with very varying results. In some cases it has been found useful when combined with cinchona bark or other tonics, in intermittents. Baths of valerian have also been found of value in acute rheumatism. In Germany, and some other parts of the continent, it is esteemed as a stimulant in the low forms of fever, but in this country it has been but little employed in such cases. As the virtues of valerian essentially reside in the volatile oil, this is a good form of administration. Valerianic acid has also been occasionally prescribed, but with no very definite results; indeed, Dr. John Harley says that in doses of "two drachms or more, it appears to have the same action as so much acetic acid, causing gastric irritation, nausea, and colicky pains, followed by slight exhilaration." But some of its salts, more especially that of valerianate of zinc, have been certainly administered with advantage in hysteria, chorea, epilepsy, &c.

Per. Mat. Med., by B. & R., p. 698; Pharmacographia, p. 337; U. S. Disp., by W. & B, pp. 881 and 981; Garr., Mat. Med.,

p. 288; Royle's Mat. Med., by J. Harley, p. 544; Amer. Journ. Pharm., May, 1861, p. 239, and Jan., 1867, p. 70; Wittstein's Vierteljahresschrift f. prakt. Pharm., vol. xviii (1869), p. 73; Bouchardat, Manuel de Matière Médicale, vol. i (1865), p. 290.

DESCRIPTION OF PLATE.

Drawn from a specimen collected at Cherry Hinton, near Cambridge.

1. Upper part of stem with inflorescence.
2. Lower portion of stem with roots.
3. A flower.
4. Vertical section of the same.

5 and 6. Fruit.

7. Transverse, and—8 and 9. Vertical section of the same.

(3, 4, 6–9 enlarged.)

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